

Carnegie
Mellon
University



Blackjack Dealer with VEX-AIM

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A 15-494, 15-694 Final Project

Agenda

1. Project Overview
2. Our Approach
3. Highlights
4. Results & Challenges
5. Future Work



Project Overview

Our Goal: Simulate a blackjack dealer using the Vex-AIM robot that can...

- Physically pick up and deal cards to players
- Read and evaluate player hands
- Complete the game logic as a dealer
 - automated dealer hit/stay evaluation
 - final win/loss determination



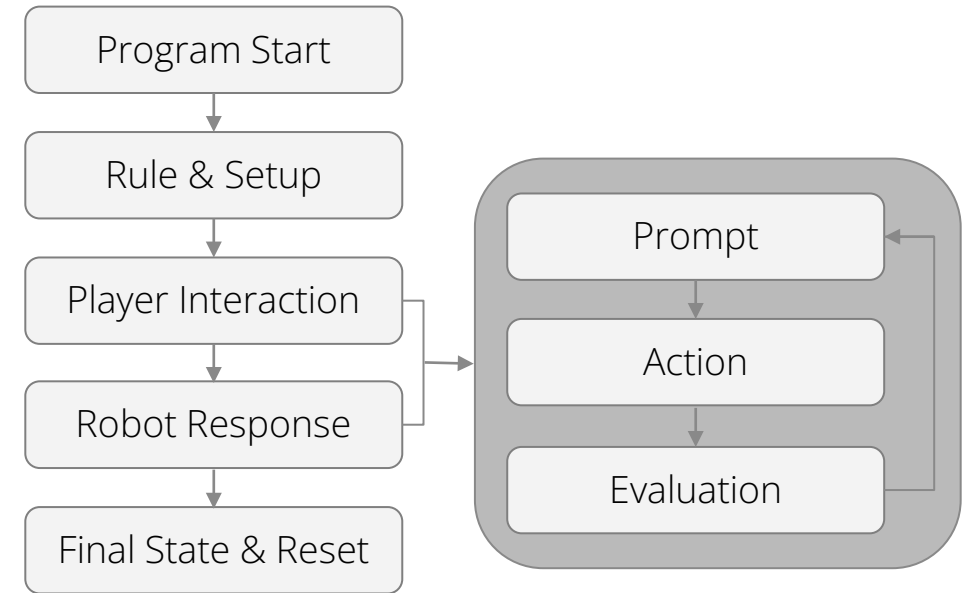
Our Approach

Hardware

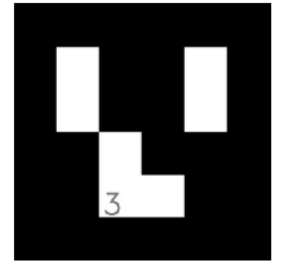
- Vex-AIM robot
- Magnet-backed playing cards
- Aruco Marker Stickers

Software

- Vex-aim-tools development framework
- Prompt-based interaction (e.g. "Hit" / "Stay")
- Path Planning & Navigation with RRT



Highlights



Our Highlight:

- Robot **physically** deals **real cards**
 - Placing small pieces of magnetic tape at the back of the cards to take advantage of magnetism in the kicker
- Card **information association** with Aruco marker stickers
 - Ex. ArucoMarker-3 sticker was placed on 3 of clubs, which upon discovering in the world map, the robot takes note of as it plans the path and deals the card
- **LLM** based interactions
 - Utilizes the GPT-4 to handle interaction with the player
- RTT **Path Planning** utilizing **AruCo markers**
 - Allows more reliable movement accuracy and localization

Successes & Challenges

Successes:

- ✓ Piloting to marker objects (on cards)
- ✓ Physical card dealing
- ✓ Point tracking and tallying

Challenges:

- ⚠ Automatic deck dispensing system
- ⚠ Very occasional failed card pickups
- ⚠ Text-to-Speech pronunciation

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Remember you are the dealer when play blackjack game, every time you mention you or dealer during the game you need to associate dealer with you.
Remember in this game, arucomakers you see will be regarded as poker cards,
Remember, "ArucoMarker-10" is "10" in poker card,
    "ArucoMarker-11" is "A" in poker card,
    "ArucoMarker-12" is "A" in poker card,
    "ArucoMarker-13" is "K" in poker card,
    "ArucoMarker-9" is "9" in poker card,
    "ArucoMarker-8" is "8" in poker card,
    "ArucoMarker-7" is "7" in poker card,
    "ArucoMarker-5" is "5" in poker card,
    "ArucoMarker-6" is "6" in poker card,
    "ArucoMarker-4" is "4" in poker card,
    "ArucoMarker-3" is "3" in poker card,
    "ArucoMarker-2" is "2" in poker card.
Remember when I ask you calculate total points for player or dealer, you need to calculate according to the value of poker card related to the arucomakers,
Remember what arucomarkers you pick for dealer and what arucomarkers you pick for player,
Remember when you want to calculate the total points, you need to remember what arucomarker you have picked,
    and calculate total points according to arucomakers relation to poker cards,
    You need to regard ArucoMarker as pokercard and do not mention "Arucomaker" forever, instead, you should say poker card

Let's play blackjack game. Remember you are the Dealer of the game.
you should first tell me you are the dealer and I am the player and then ask if player want me to explain the game rules first,
afrrer this, if I tell you we can continue,
and then you should start to pick the poker card and send it to dealer and player,
you need to start to send dealer's card which is your card,
and then you should output "#pickonecardfordealer A" without quotes, and tell me this is dealer's first card,
and then you should output "#pickonecardforplayer A" without quotes, and tell me this is player's first card,

and then you should tell me you will send second card to player,
after this, then you should output the string "#pickonecardforplayer B" without quotes,
and then tell me this is player's second card,
after this, you should ask player want to stay or hit,
if my answer is stay, you need to pick the second card for dealer and output "#pickonecardfordealer C" without quotes,
    and then output the string "#computefordealer " without quotes,
    if total points of dealer's cards you calculate are less than 17, you need to directly output "#pickonecardfordealer D" without quotes,
    and then output the string "#computefordealer " without quotes to check again if it is smaller than 17,
    if total points of dealer's cards you calculate are 21, you need to start the action when dealer wins the game,
if my answer is hit, you should tell me you will get one more card for player, and output "#pickonecardforplayer C" without quotes,
    after this, you need to and then output the string "#computeforplayer " without quotes,
    and then tell me whether player busts everytime he choose to hit,
    after checking, and then ask me again if I want to stay or hit.

At the end, you need to remember what arucomarker you have picked for dealer and player,
and calculate each total points according to arucomakers relation to poker cards,
and then compare who wins the game.
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Future Work

Improvements:

- **Deck handling**
 - add an automatic way to dispense new card after the old one is picked up
- **Enhanced input and improving state transitions**
 - Try for a more hand-free and smoother experience (e.g. only speech, more interactions)
- **Scaling up**
 - Increasing the number of players allowed at a time
 - Expanding playing area





Video Demo

Background source: internet

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15494/15694
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DEALER
VEX AIM ROBOT

VS

You

PLAYER





Thank you so much!