



# Introduction to AI Quadruped Racing Game

Provided on March 28, 2024

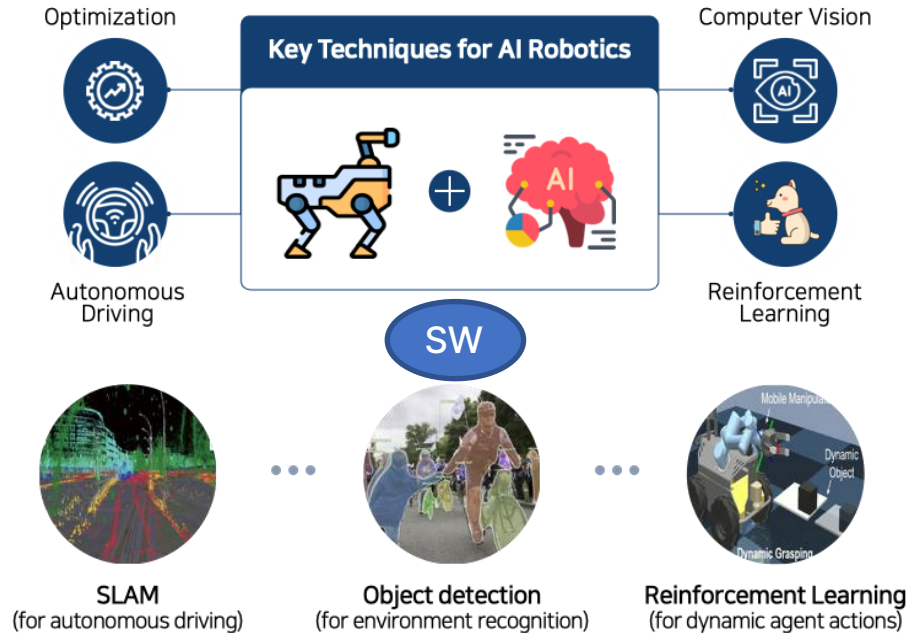
# Why Quadruped Robot?

Type	Usage	Strength	Weakness
 Humanoid	Boston Dynamics, Tesla For research and demonstration	Human-like behavior	Hard to balance Requires large computation power
 Wheel robot	SECOM, Knightscope, Hyundai For delivery, service, patrol, etc.	Easy to use	Difficult to overcome rough terrain
 Drone	DJI, Flytbase, Amazon For delivery, surveillance, agriculture, etc.	Can avoid traffic through flight	Flight time limitation due to battery capacity
 Quadruped Robot	Anymal, Boston Dynamics, Unitree, Ghost Robotics For research, surveillance, inspection, etc.	Various uses possible	Mechanical lifespan exists

# What to learn for AI Quadruped Robot?



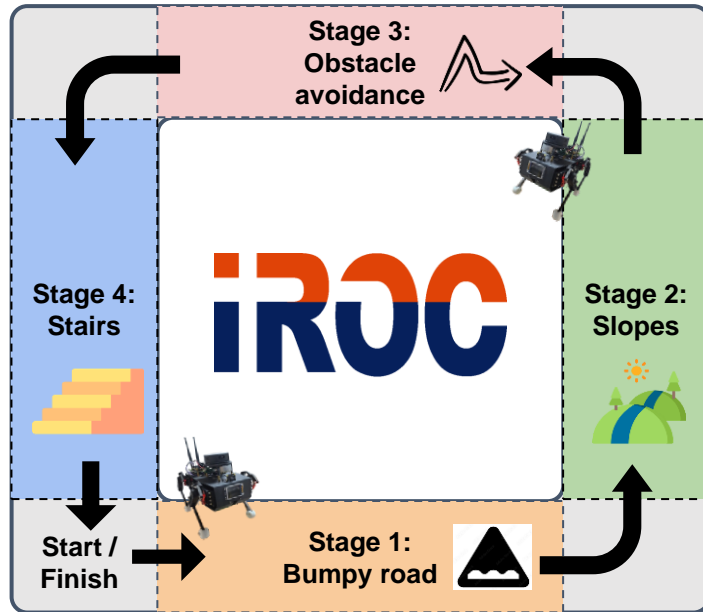
Quadruped Robot: Specter-X



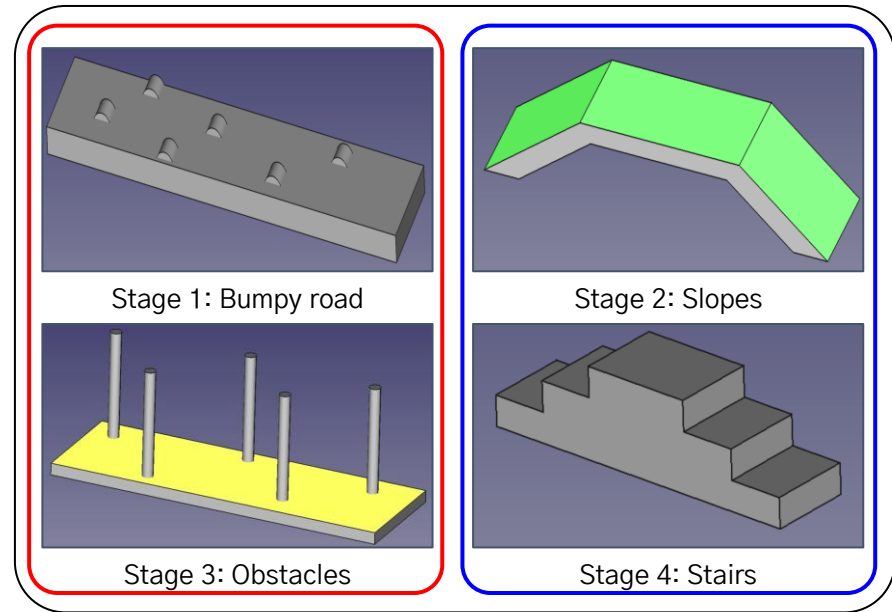
# AI quadruped racing game at IROC

## AI quadruped racing game

- Four stages to complete
- Each stage tests abilities such as stabilization and balancing, sensor management, obstacle avoidance, etc.
- The goal of the game is to reach the finish area as quickly as possible without losing its driving ability.



Course for AI Quadruped racing game



**Planned for  
3Q of 2024**

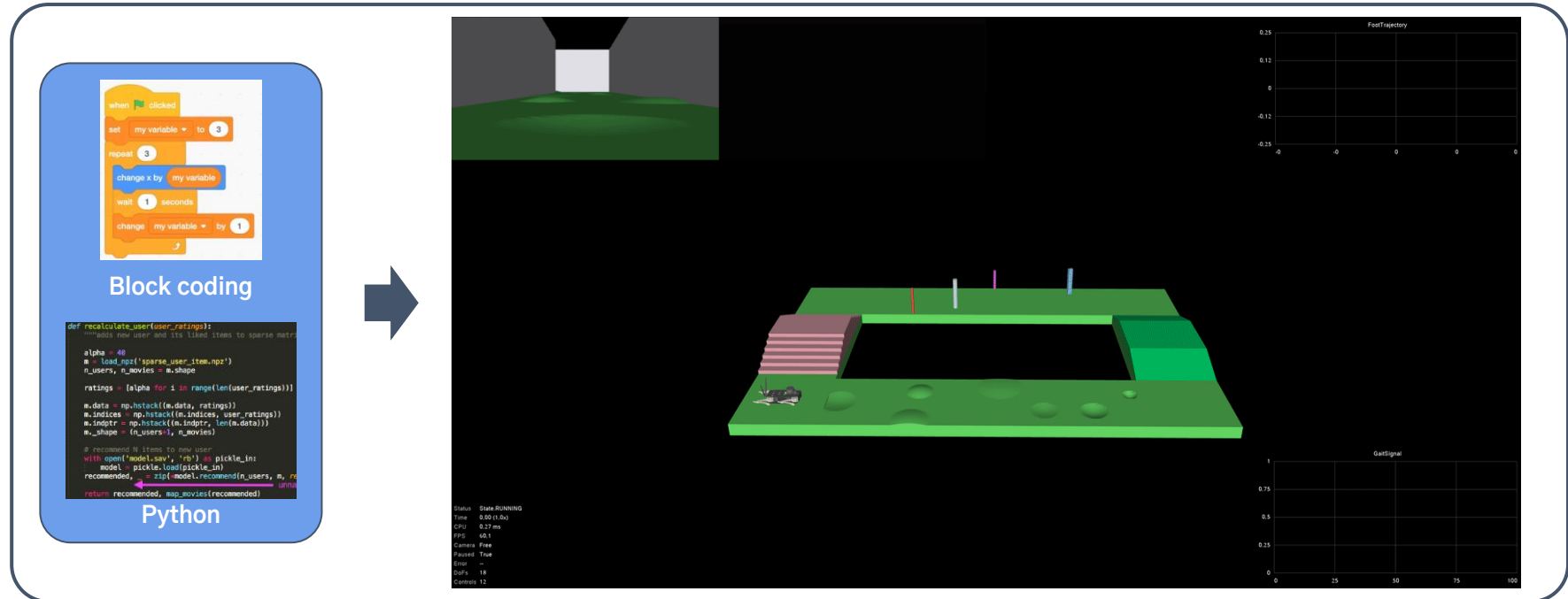
Course for each stage

**Planned for  
1Q of 2025**

# Simulator to Real world

## Two phases in AI Quadruped Racing game

- 1. Simulator:** A quadruped agent is trained for the racing game in the simulator.
- 2. Real site:** Applying the trained agent (code), potentially after fine-tuning it, to a quadruped robot in preparation for a competition



Block coding

```

when clicked
  set my variable to 3
  repeat 3
    change x by my variable
  wait 1 seconds
  change my variable by 1
            
```

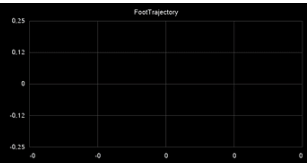
Python

```

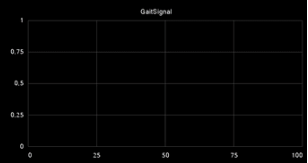
def recalculate_user(user_ratings):
    #indices for user and its likes into sparse matrix
    alpha = 40
    m = load_npz('sparse_user_item.npz')
    n_users, n_movies = m.shape
    ratings = [alpha for i in range(len(user_ratings))]
    m.data = np.hstack([m.data, ratings])
    m.indices = np.hstack([m.indices, user_ratings])
    m.indptr = np.hstack([m.indptr, len(m.data)])
    m.shape = (n_users+1, n_movies)
    # recommend N items to new user
    with open('model.sav', 'rb') as pickle_in:
        model = pickle.load(pickle_in)
        recommended_movies = model.recommend(n_users, m, n)
    return recommended_movies, map_movies(recommended)
            
```

Status: State: RUNNING  
 Time: 0.00480s  
 CPU: 0.27 ms  
 FPS: 60.1  
 Camera: Free  
 Paused: True  
 Error: —  
 FPS: 18  
 Controls: 12

FootVelocity



GaitSignal

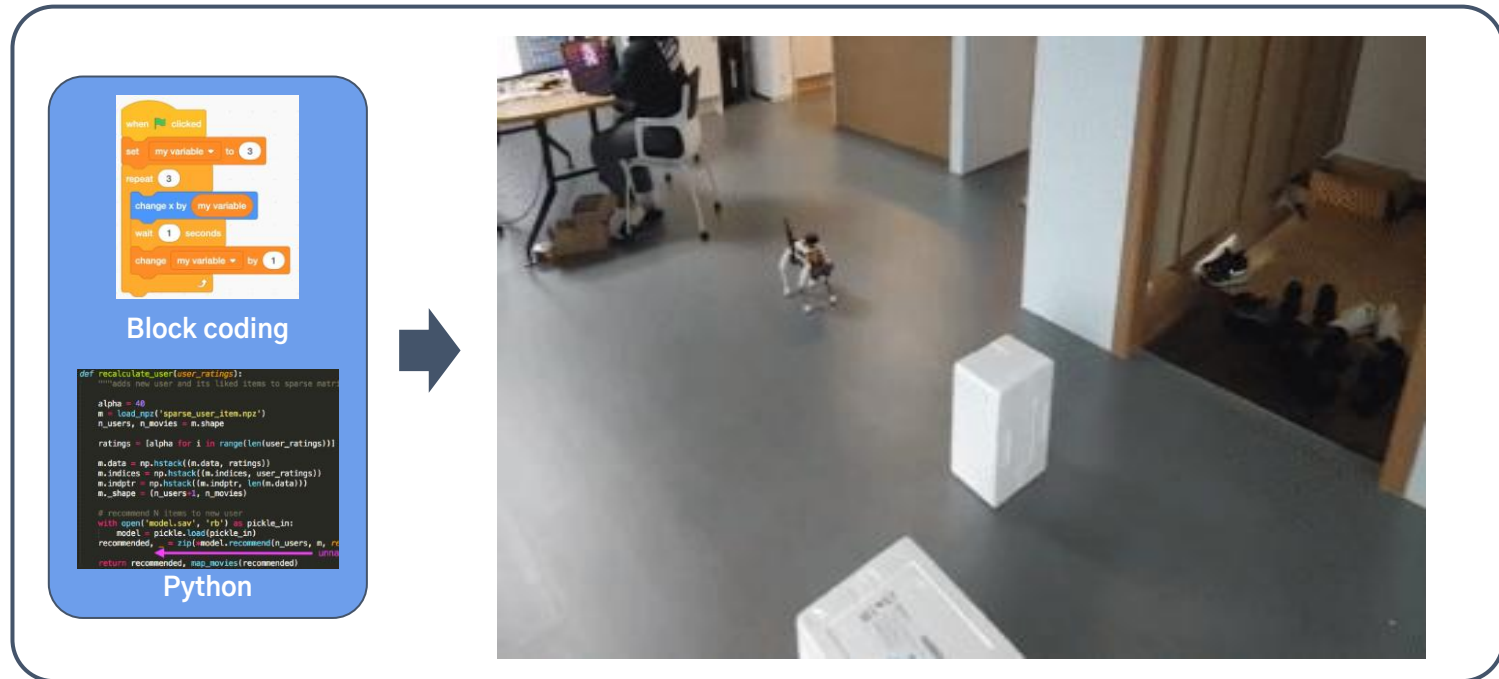


1<sup>st</sup> phase: Simulator (Video)

# Simulator to Real world

## Two phases in AI Quadruped Racing game

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2<sup>nd</sup> phase: Real site (Video)

# System Requirements

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**The local version of the AI Quadruped Racing game** currently only supports **Ubuntu 22.04 OS**:

- **GPU** (Graphic card, nVIDIA) is required for **training the quadruped agent**.
- Minimum & Recommended requirements will be shared soon.
  
- **The Cloud/Web-based version** of the game will be released and announced through the IRO homepage.
  
- Seniors are required to have a basic understanding of programming, particularly in Python.
- Distribution of the simulator for juniors supporting block coding is planned.

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