Voice-Controlled Robotic Manipulation

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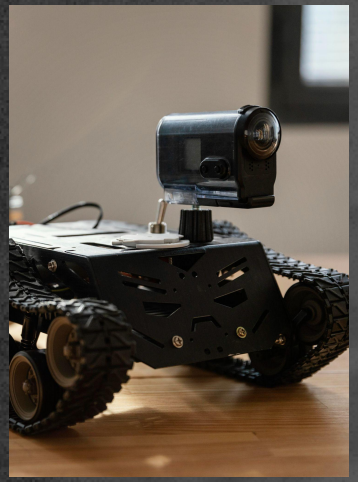
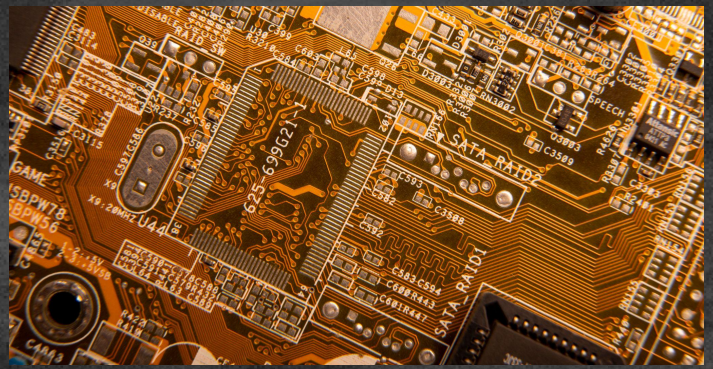




Problem Statement

- Communication gap between humans and robots

- Complexity in translating natural language to robot actions

- Limited real-time interaction capabilities

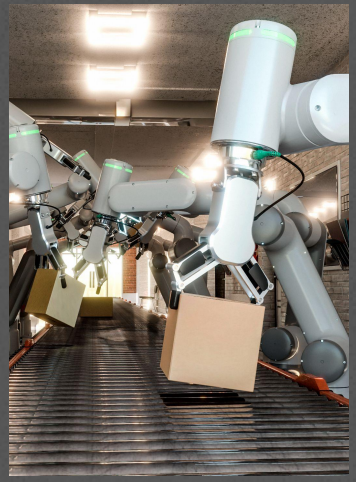
- Requirement for extensive technical knowledge to operate robots

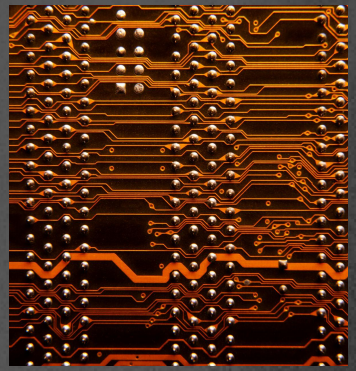
Introduction

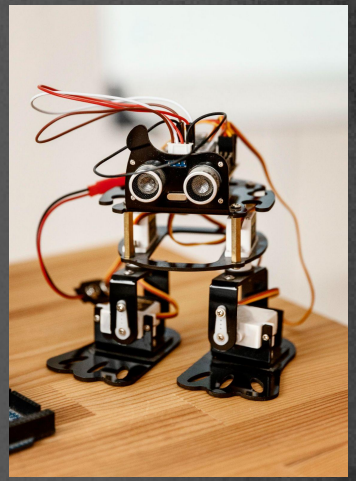
- Bridging human-robot communication through natural language

- Integration of cutting-edge technologies
  - Natural Language Processing
  - Advanced Robotic Control
  - Dynamic Simulation

- Focus on intuitive and effective interaction







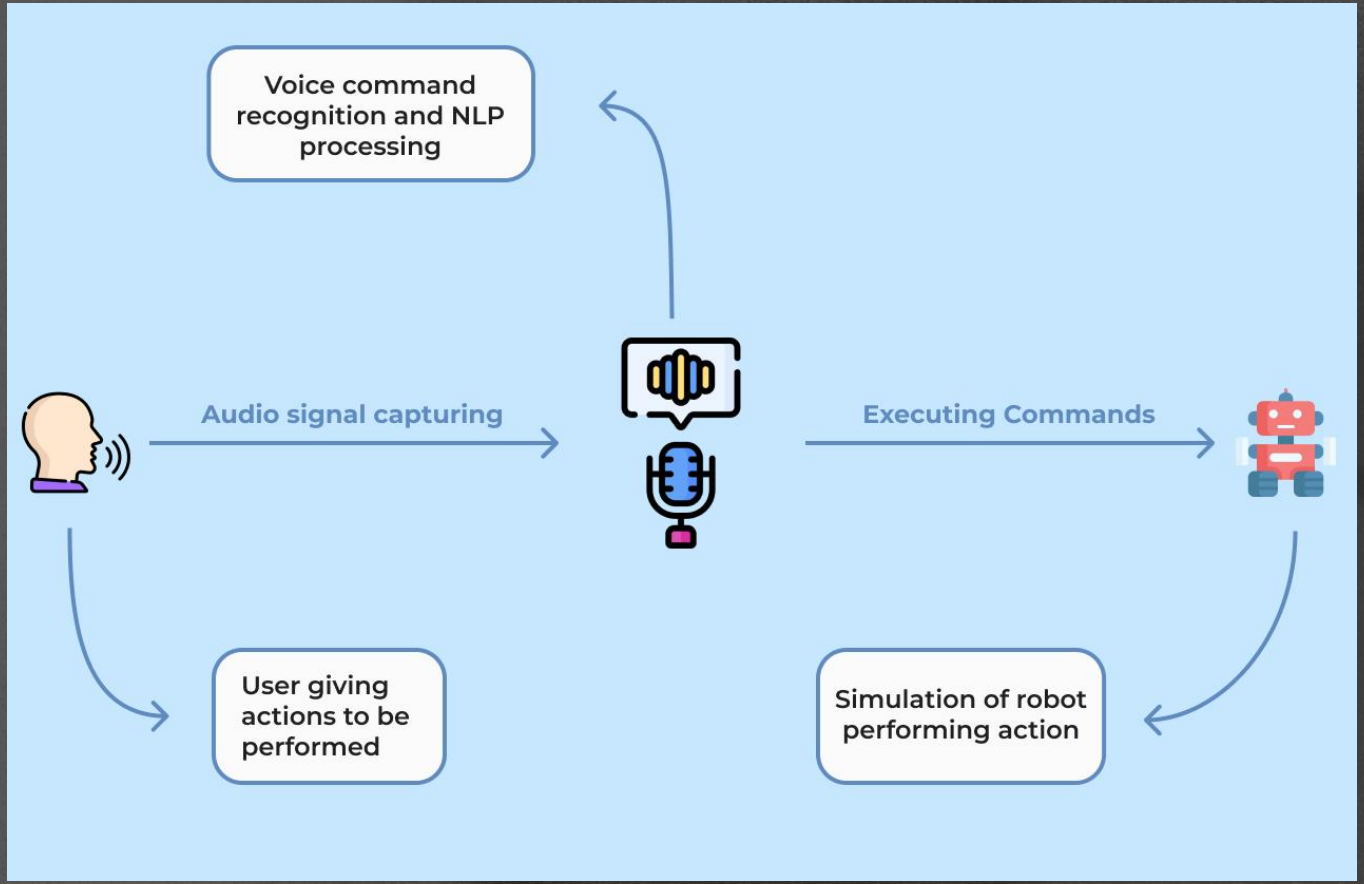
System Overview

- Voice Command Recognition System

- Natural Language Processing Engine

- Robotic Navigation & Manipulation

- PyBullet Simulation Environment


Voice command recognition and NLP processing
Audio signal capturing
Executing Commands
User giving actions to be performed
Simulation of robot performing action

Tools & Libraries

- NLP
  - SpeechRecognition
  - PyAudio
  - NLTK
- Robotics
  - PyBullet
  - PyBullet_Data
  - Pyb_utils
  - GraspTrajOpt

Robot Model: - Fetch

Voice Command Processing

- Integration with Google's Web Speech API

- Background noise minimization

- Real-time audio processing capabilities

- Conversion of speech to text for NLP processing

Natural Language Processing

- NLTK-based language processing

- Segmentation of commands into actionable instructions

- Command validation and error handling

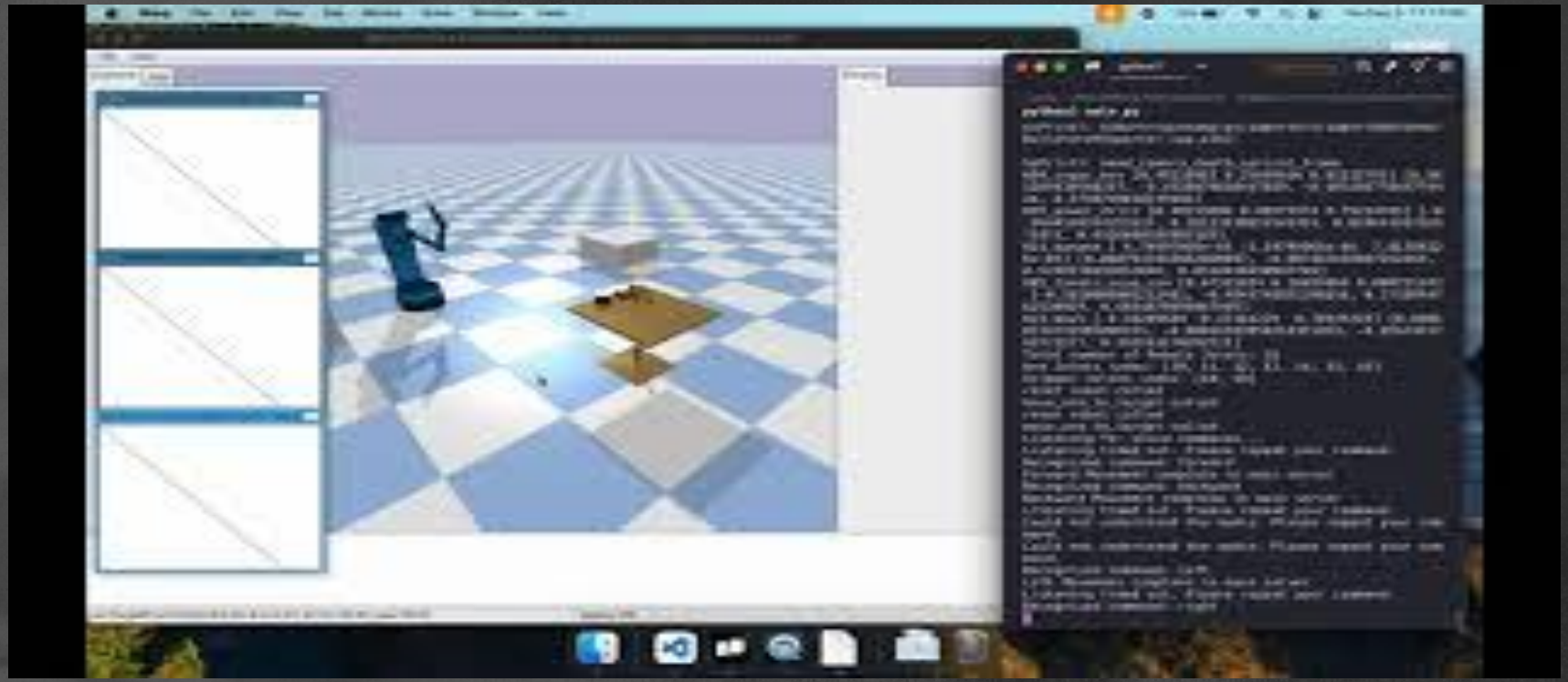
Robot Navigation Control

- Forward/backward motion control

- Left/right movement capabilities

- Rotation and orientation control

Demo



Object Manipulation

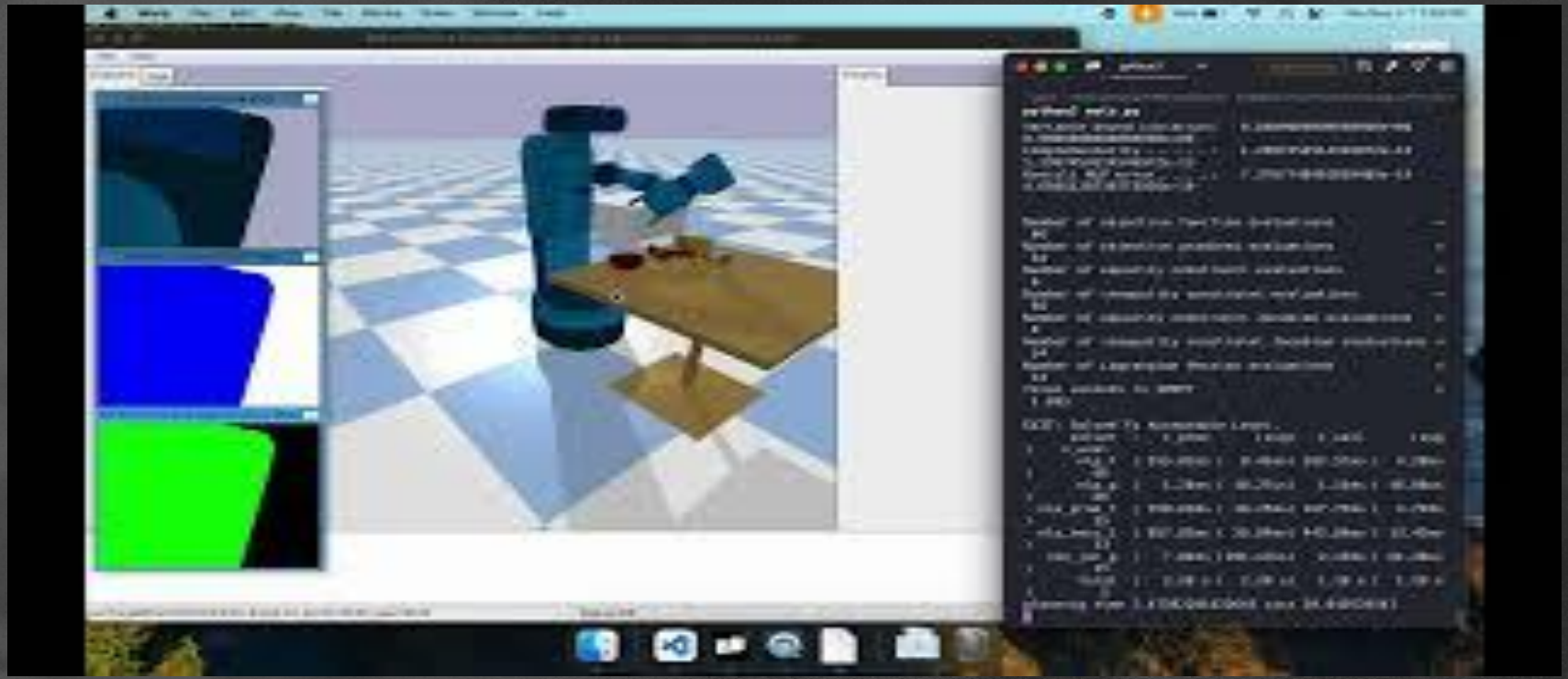
- Object & Collision detection

- Grasp position and orientation calculation

- Approach trajectory planning

- Grasping motion control

Demo



Real World Applications

- Assistive Robotics

- Education and Research

- Healthcare

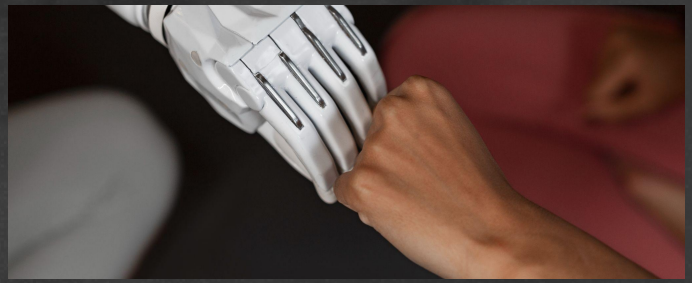
- Entertainment & Hospitality

Future Work

- Advanced AI and NLP

- Enhanced Collision Avoidance

- Improved Mobility



Thank you!