Language Guided Manipulation System
Problem Statement

- This project involves complex language understanding and response mechanisms for the Robot using the PyBullet Library and Simulation Environment along with tailored NLP libraries.

- The challenge lies in enabling the robot to understand and respond to natural language in the Language Guided Manipulation System simulation, offering valuable insights into human-robot communication.

- This project promises to enhance the robot interactions with humans through advanced language processing.
Tools & Libraries

NLP
- SpeechRecognition
- PyAudio
- spaCy
- NLTK

Robotics
- PyBullet
- PyBullet_Data
Robot Model

Robot Model - R2D2

Links: axis, leg1, leg2, body, head, rod, box.

Joints: leg1connect, leg2connect, tilt, swivel, periscope, boxconnect.

Geometry: Each link has specific geometrical shapes (cylinder, box, sphere) with defined sizes, and the joints have specific motion limits and axes.

Colors: Gray, White & Blue.

Collision Properties: Collision aspects are defined for each link with specific geometries and contact coefficients.
Flow Diagram

- Program starts
- Initialize Robot
- Wait User’s Input
- Call NLP Engine
- Handle Actions
- Execute Actions
- Deactivate Robot
- Program ends
- Handle Disambiguation
Evaluation Metrics

Accuracy of Language Understanding (ALU)

\[ ALU = \frac{\text{Correctly Interpreted Inputs}}{\text{Total Inputs}} \times 100 \]

Response Appropriateness Score (RAS)

\[ RAS = \frac{\text{Contextually Appropriate Responses}}{\text{Total Responses}} \times 100 \]

We tested this by inputting values for around 80 times 71 were successful.
Real World Applications

- Assistive Robotics
- Industrial Automation
- Education and Research
- Healthcare
- Entertainment & Hospitality
- Space Exploration
Future Work

- Advanced AI and NLP
- Enhanced Sensory Capabilities
- Improved Mobility and Dexterity
- Autonomy and Decision Making
- Human Robot Interaction
- Energy Efficiency & Sustainability
Thankyou !!