



Language Guided Manipulation System



Outline

Problem Statement

Tools & Libraries

Robot Model

Flow Diagram

Demo

Evaluation Metrics

Applications

Future Work

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.

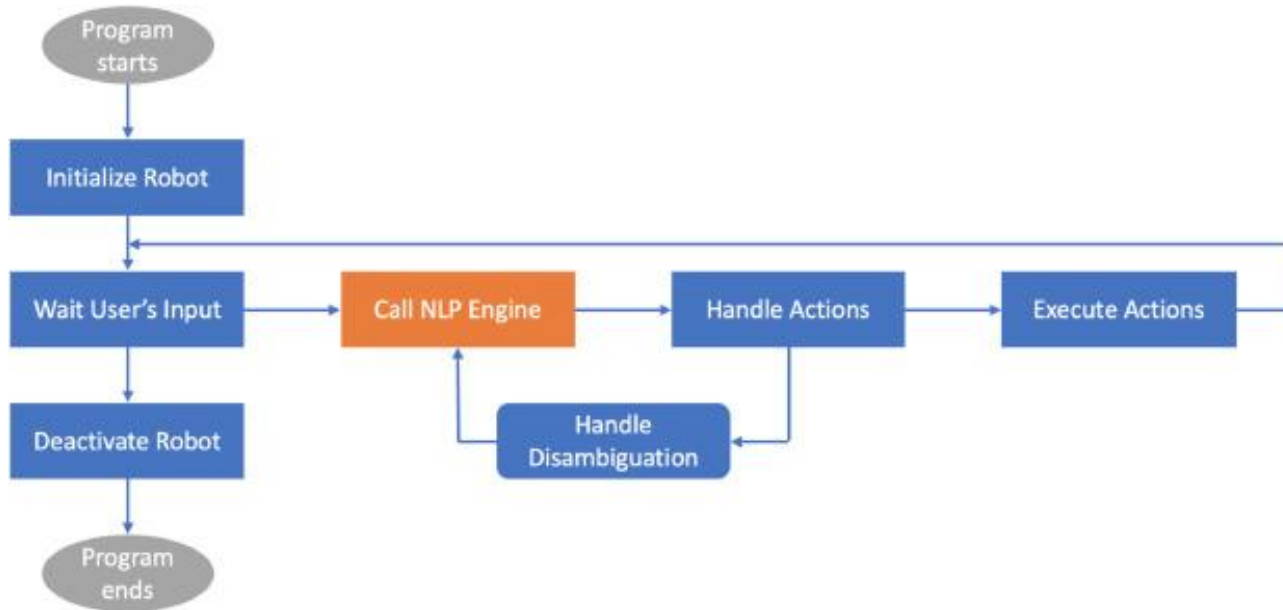
Geometry: Each link has specific geometrical shapes (cylinder, box, sphere) with defined sizes, and the joints have specific motion limits and axes

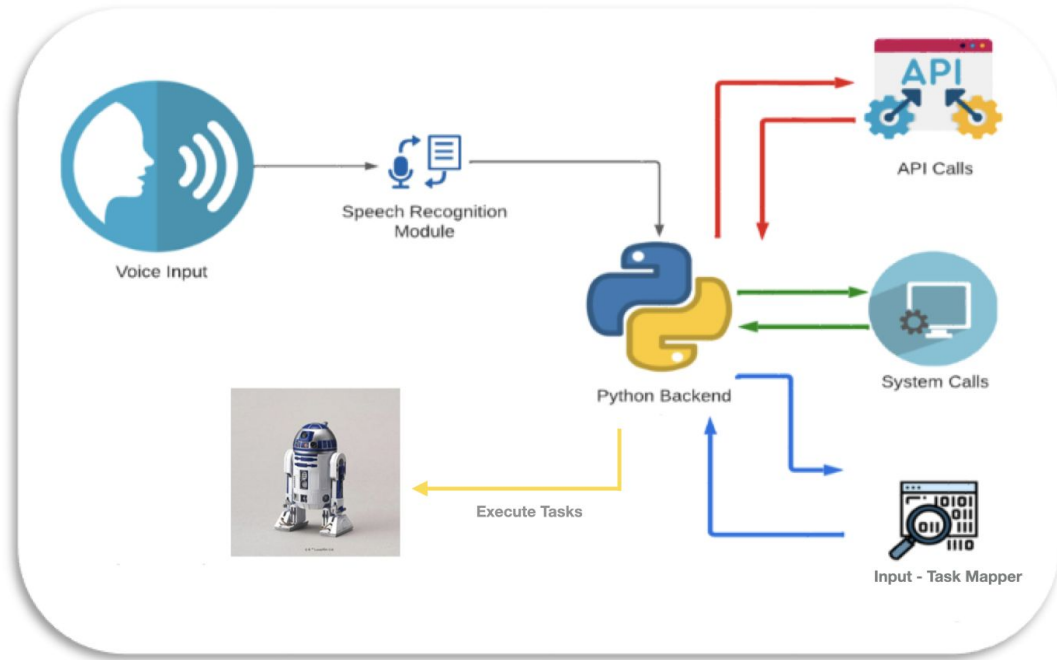
Colors: Gray, White & Blue.

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

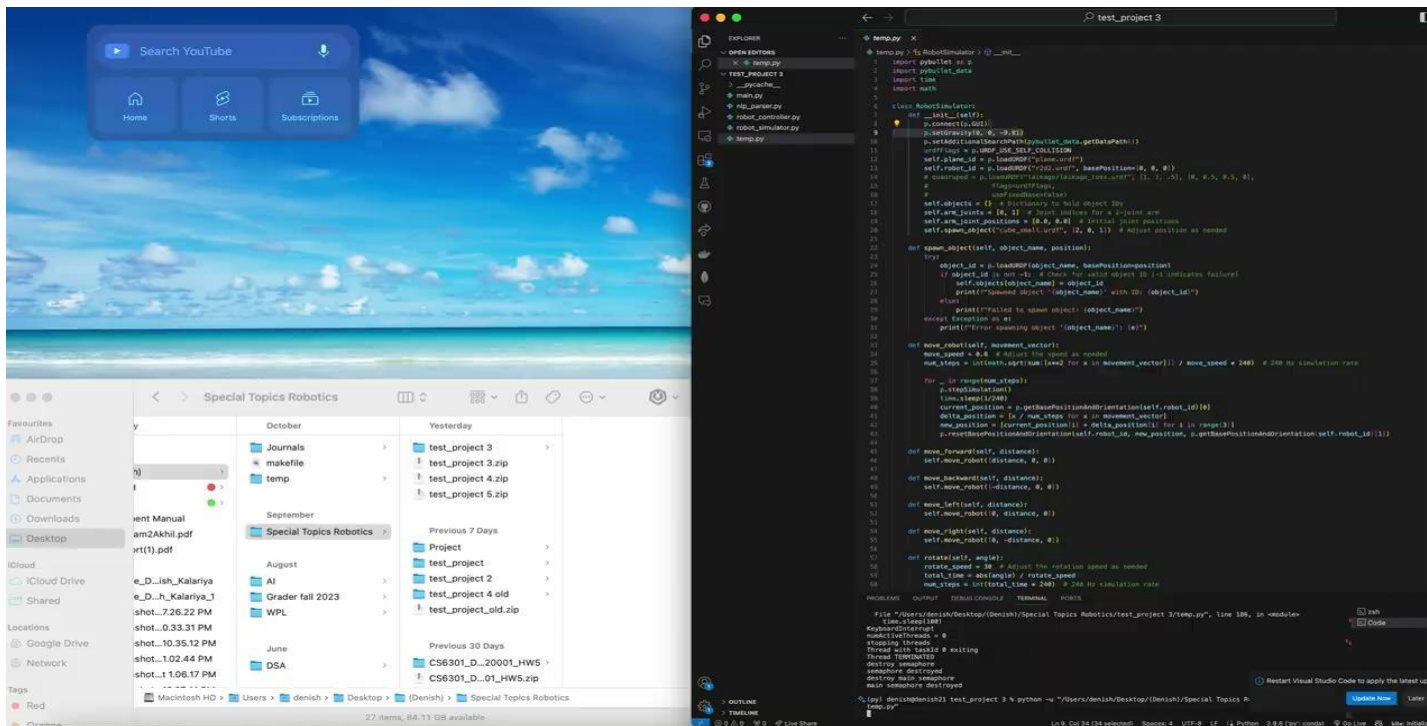


Flow Diagram





Demo



Evaluation Metrics



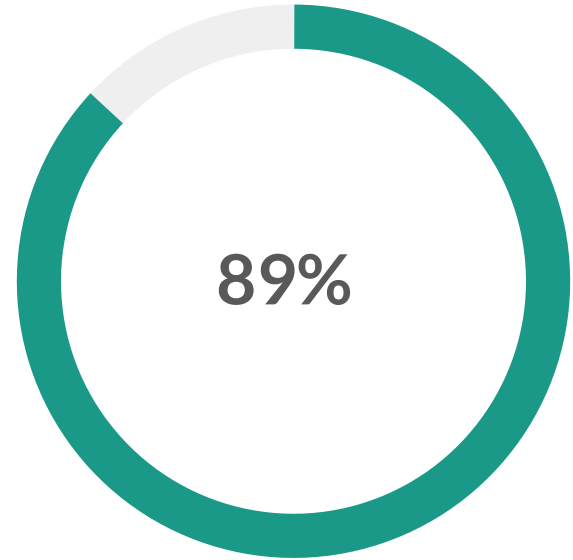
Accuracy of Language Understanding (ALU)

$$ALU = \frac{(CorrectlyInterpretedInputs)}{(TotalInputs)} * 100$$

Response Appropriateness Score (RAS)

$$RAS = \frac{(ContextuallyAppropriateResponses)}{(TotalResponses)} * 100$$

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
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Thankyou !!