

# Human-Robot Interaction Using Gestures and Speech Recognition

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## Background

The aim of this project is to develop a reliable HRI interface for remote control of the Kuka youBot based on human gestures or speech recognition. Speech and gesture recognition are both important assets in robotic systems that increase the robots ability to interact with human beings who can use the most natural form of communication to control the robot.

## Used Technology

### Leap Motion Controller

Leap Motion Controller (Figure A) is an USB sensor device released in July 2013 by Leap Motion Inc., designed to provide real-time tracking of hands and fingers in three-dimensional space with 0:01 millimeter accuracy. Leap Motion Controller uses two monochromatic IR cameras and three infrared LEDs for hand tracking and gesture recognition to a distance of about 1 meter. Some of the parameters Leap can detect are shown on Figure B and Figure C.



## Microsoft Speech Recognition Engine

Microsoft Speech Recognition Engine (or speech recognizer) takes an audio stream as input and turns it into a text transcription.

### Kuka youBot

This robot is presented on Figure D. Its key features are:

- omnidirectional mobile platform
- 5-DOF manipulator
- two finger gripper
- open interfaces
- arm and platform can be used independently.

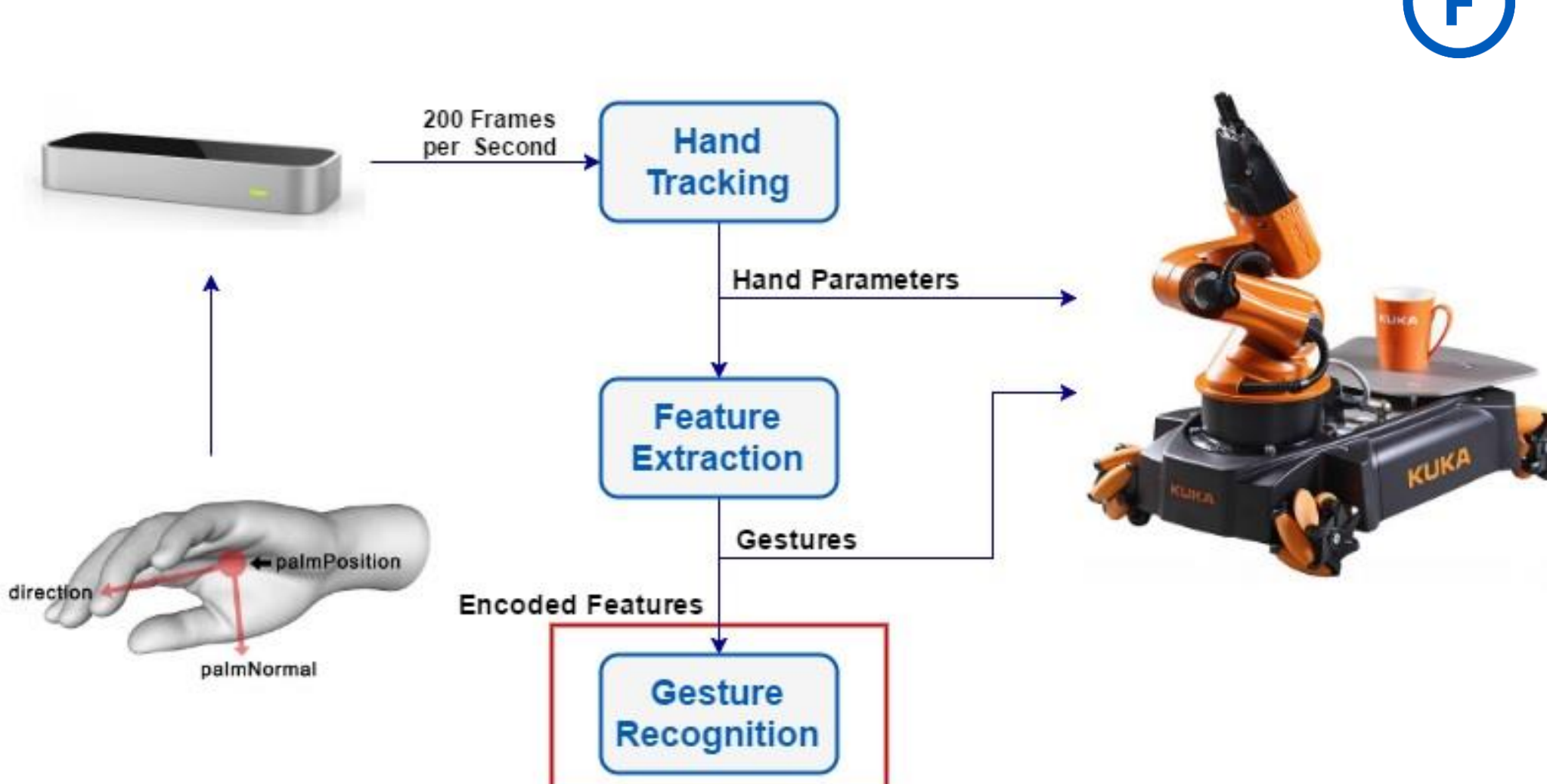


## Software

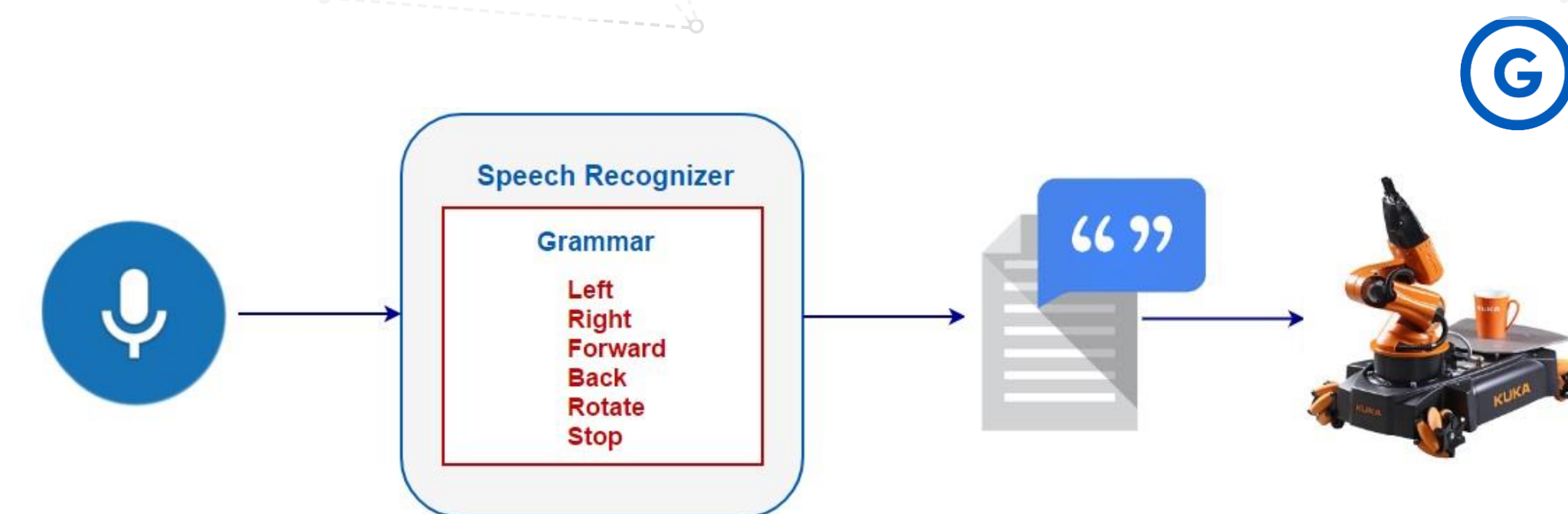
For this project we used Python 3.5.2, Ubuntu 14.04, Leap Motion SDK V2.3.1, ROS Indigo and Microsoft Speech Platform SDK 11.

## Algorithm and Results

### Hand Gesture Control



## Voice Control



## Rviz Visualization

Rviz is a 3D visualization tool for ROS. Using Rviz we can visualize the Leap Motion Controller data and demonstrate robot and object control. Figure H shows how a box object can be controlled in Rviz. The box has collision properties presented with red.

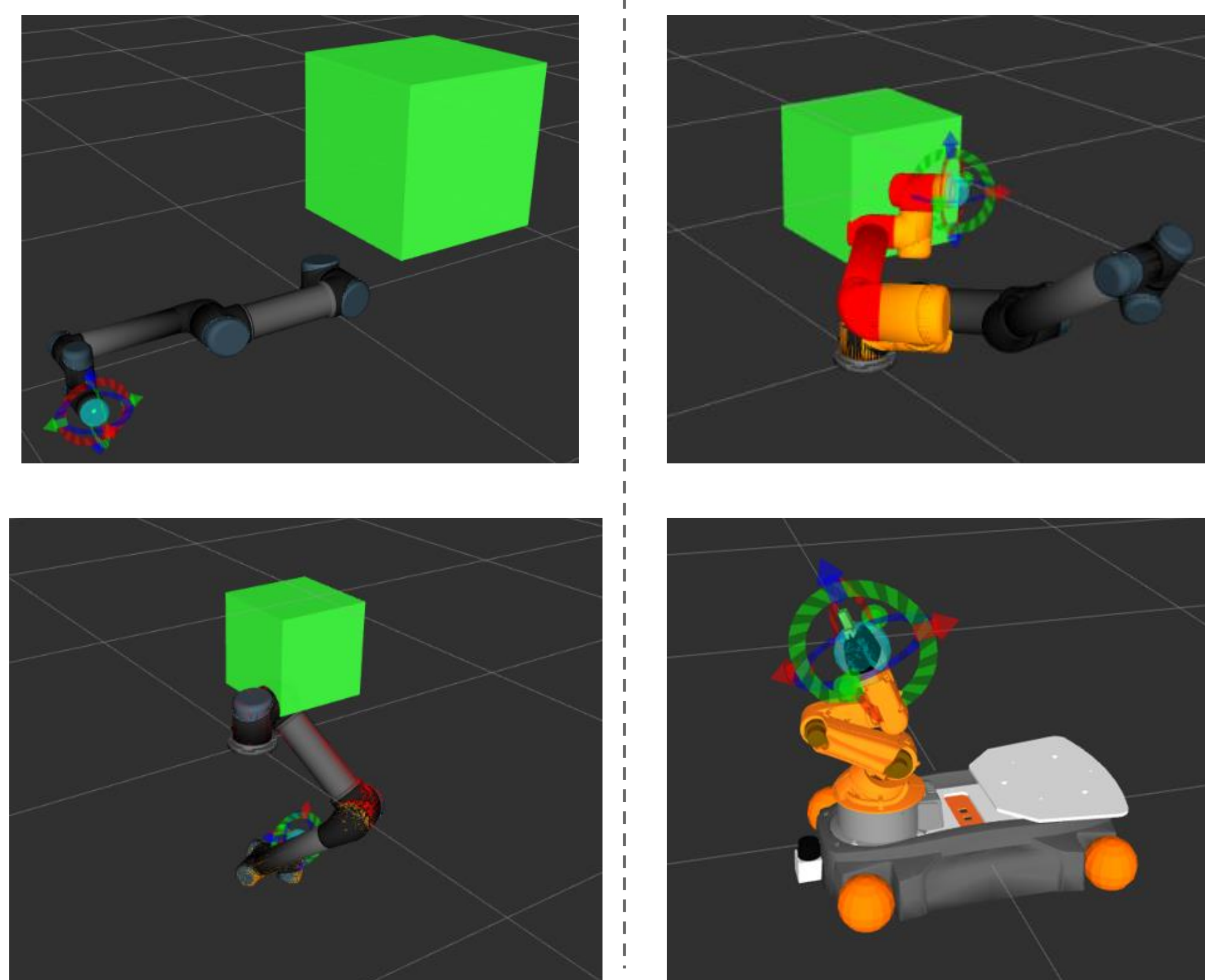
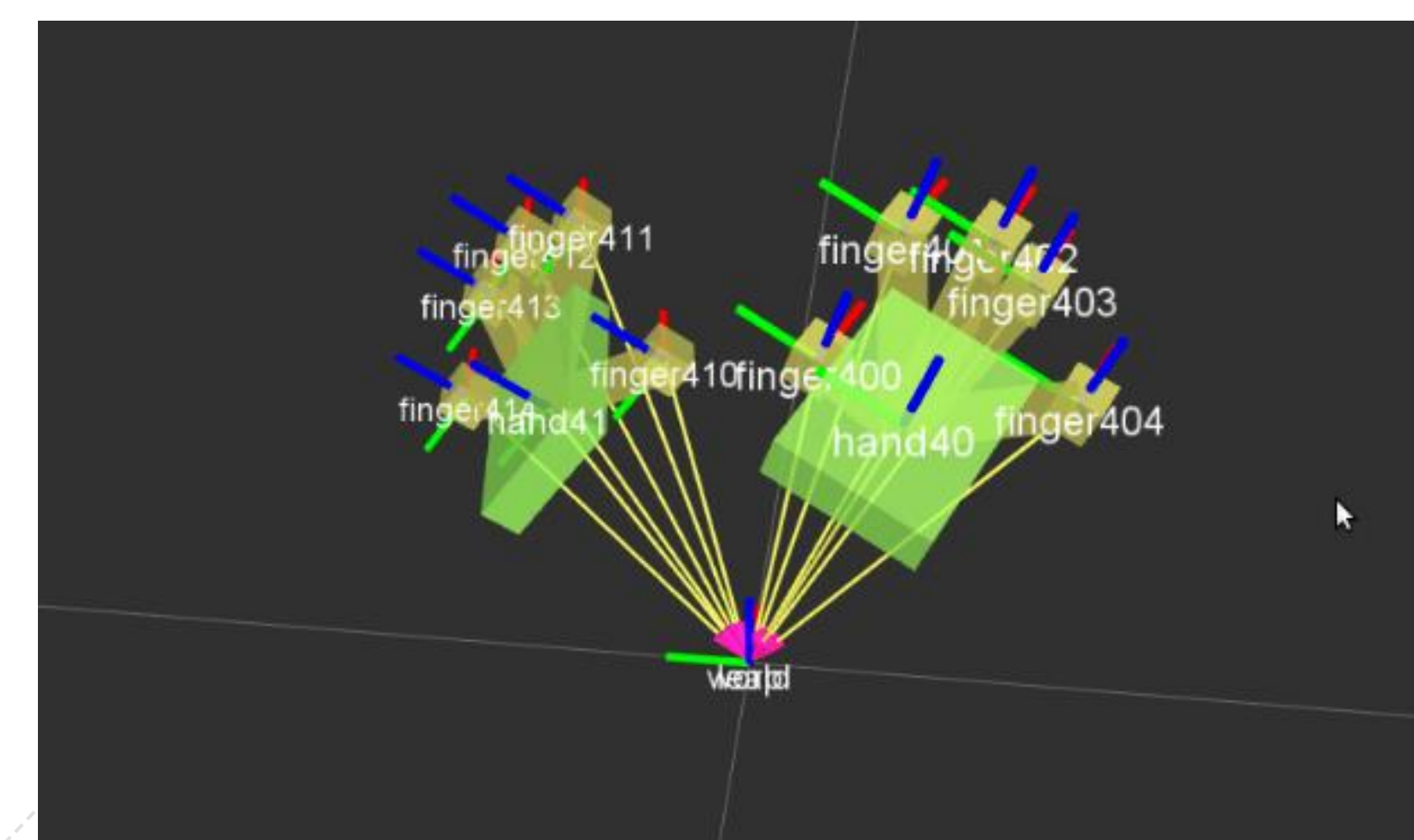


Figure I shows the Visualizer for palm, finger and fingertip tracking created in Rviz.



## Future Work

- In addition to the gesture control a person-follow option can be added.
- Movement of the robotic arm
- Implementation of the robot voice control

## Conclusion

The release of the Leap Motion Controller which is 200 times more sensitive than existing touch free technologies and the improvement of the speech recognition algorithms represent a huge leap forward for the development of alternative means of robotic control. This project showed that gesture control in terms of performance and usability is:

- Intuitive,
- Efficient and
- Easily understandable way of control.

This technology has potential to be implemented in:

- military and
- medical robotic systems.

## Acknowledgments

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## References

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