Controlling a Mobile Robot with Natural Commands based on Voice and Gesture

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Workshop on Human Robot Interaction (HRI) for Assistance and Industrial Robots. Scientific Knowledge, Standards and Regulatory Framework. How do I design for the real world?
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Outline

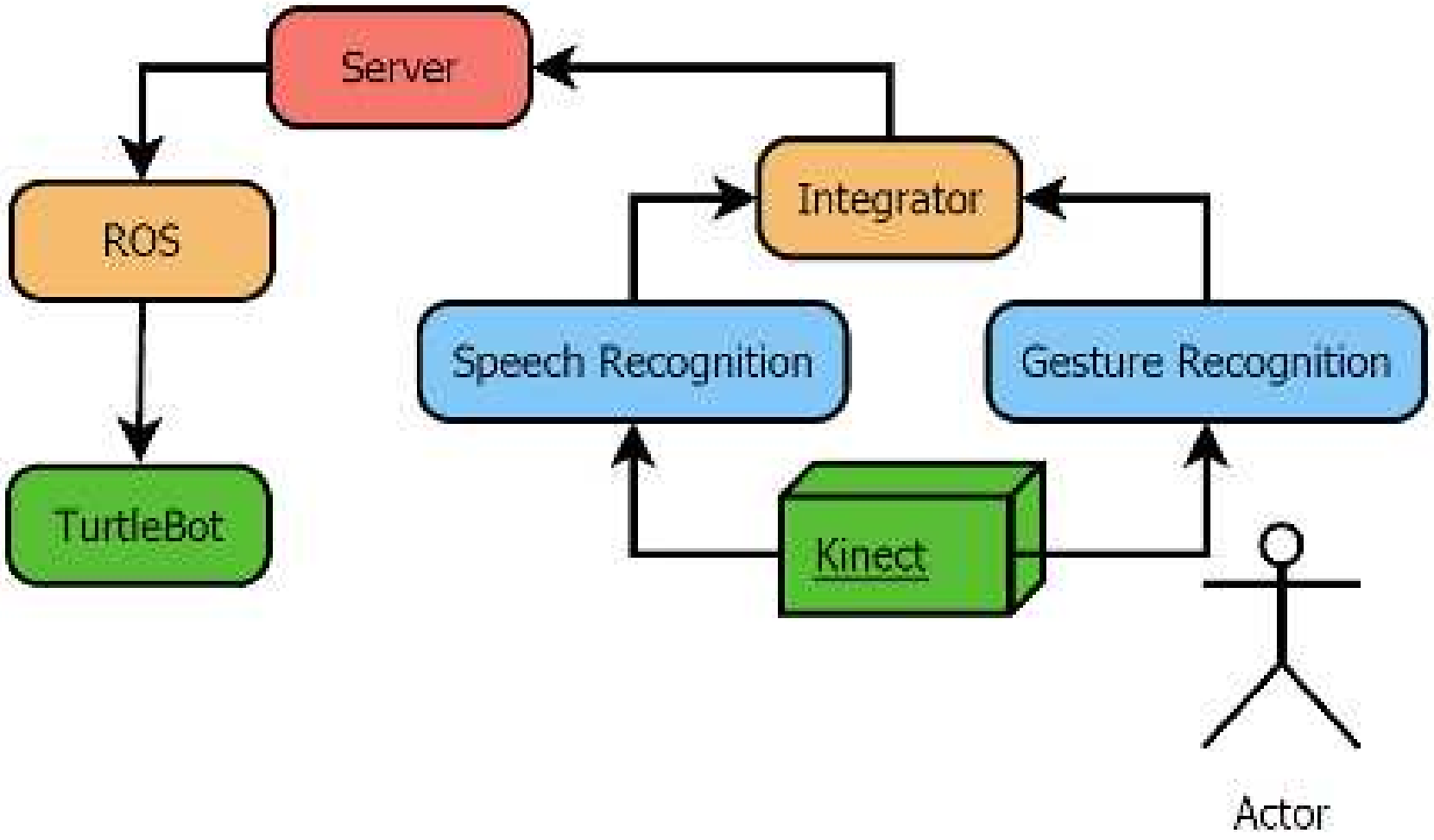
Introduction

- Complementary recognition :
  - “Go There”, “Come Here”
- Basic commands :
  - “Forward”, “left”, “right”, “faster”, “slower”, “stop”, “backwards”
- Additional clues :
  - Moving to speaker source direction.
  - Moving in a direction indicating by the user pointing hand.

Contributions

1. Defining a robust, real-time, baseline system for controlling the motion of a robot by human speech and gesture commands.
2. Integrating A&V commands for better recognition and enhanced functionality.

Proposed system architecture

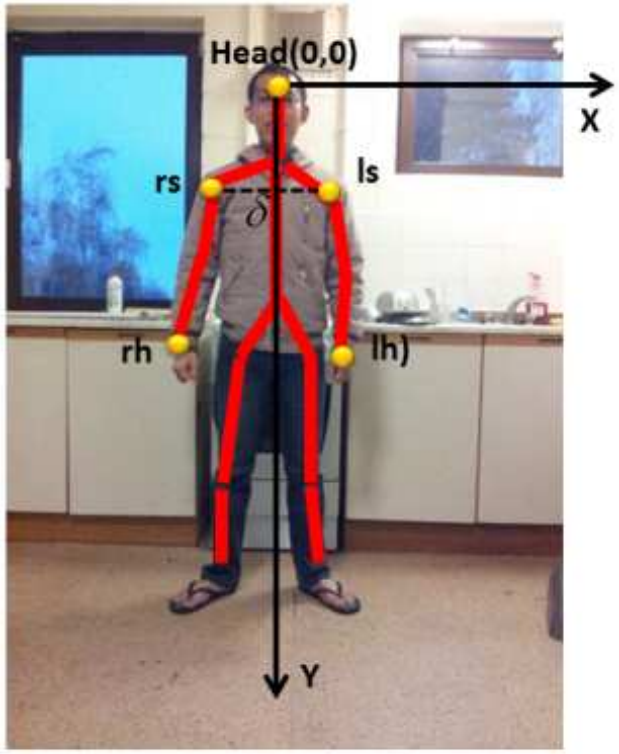


Speech Recognition

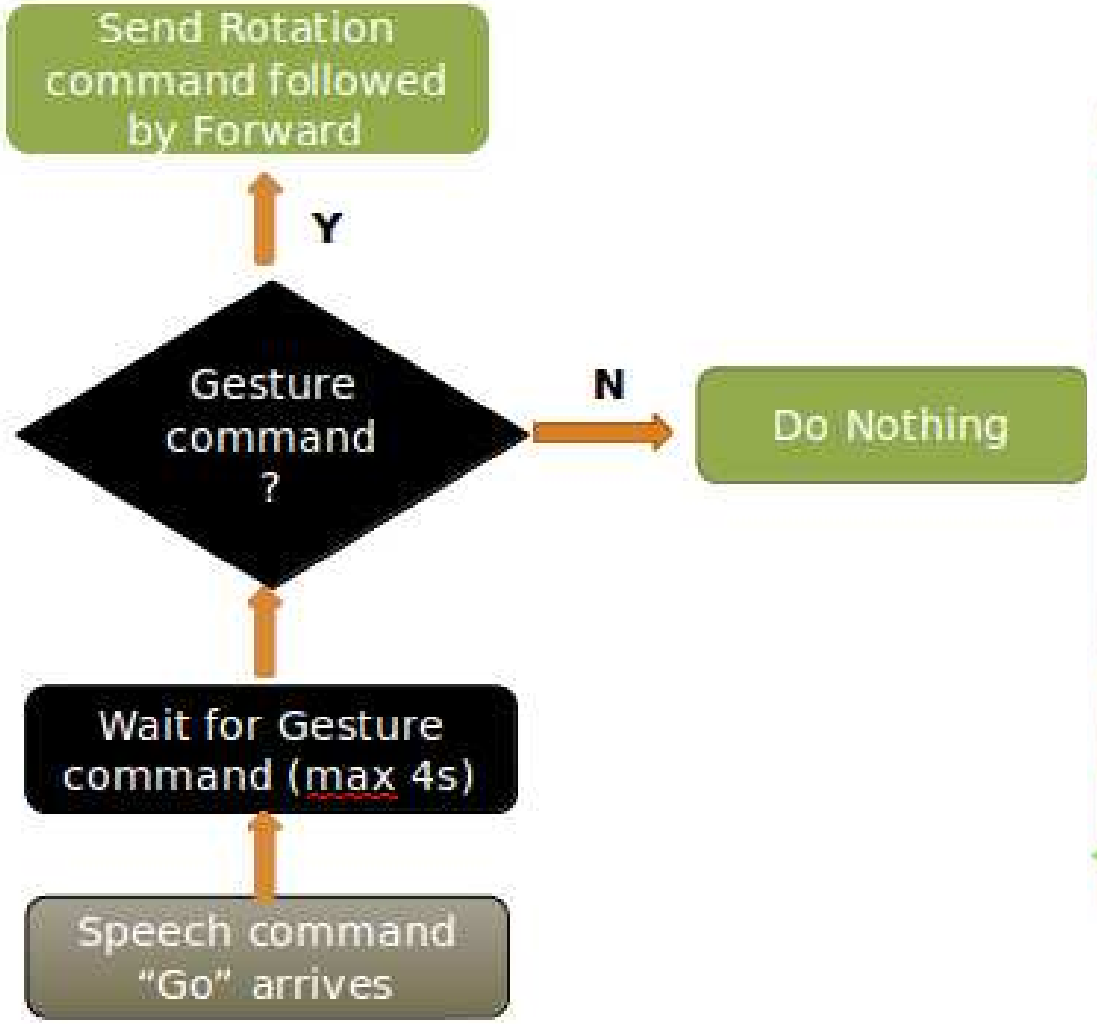
- Hidden Markov Models, n-grams models, vocabulary
- Microsoft Speech Recognition (MSR)
- Reduced Vocabulary
- Audio feedback to the user (acknowledging command / “repeat please”)

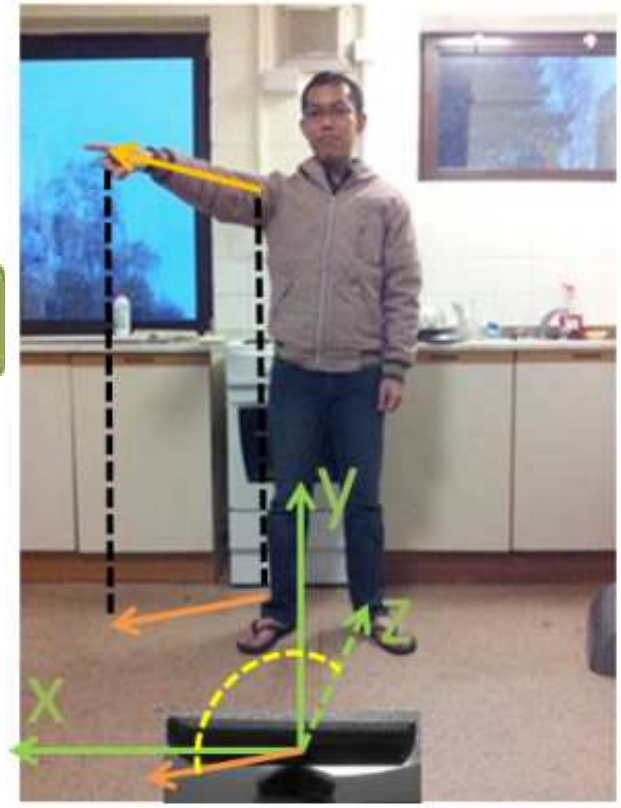
Gesture Recognition

- Kinect skeleton
- Gesture : Specific positions of one hand w.r.t. the head.
- Dynamic Time Warping, cope with different speed of execution. Parallel implementation for faster recognition.

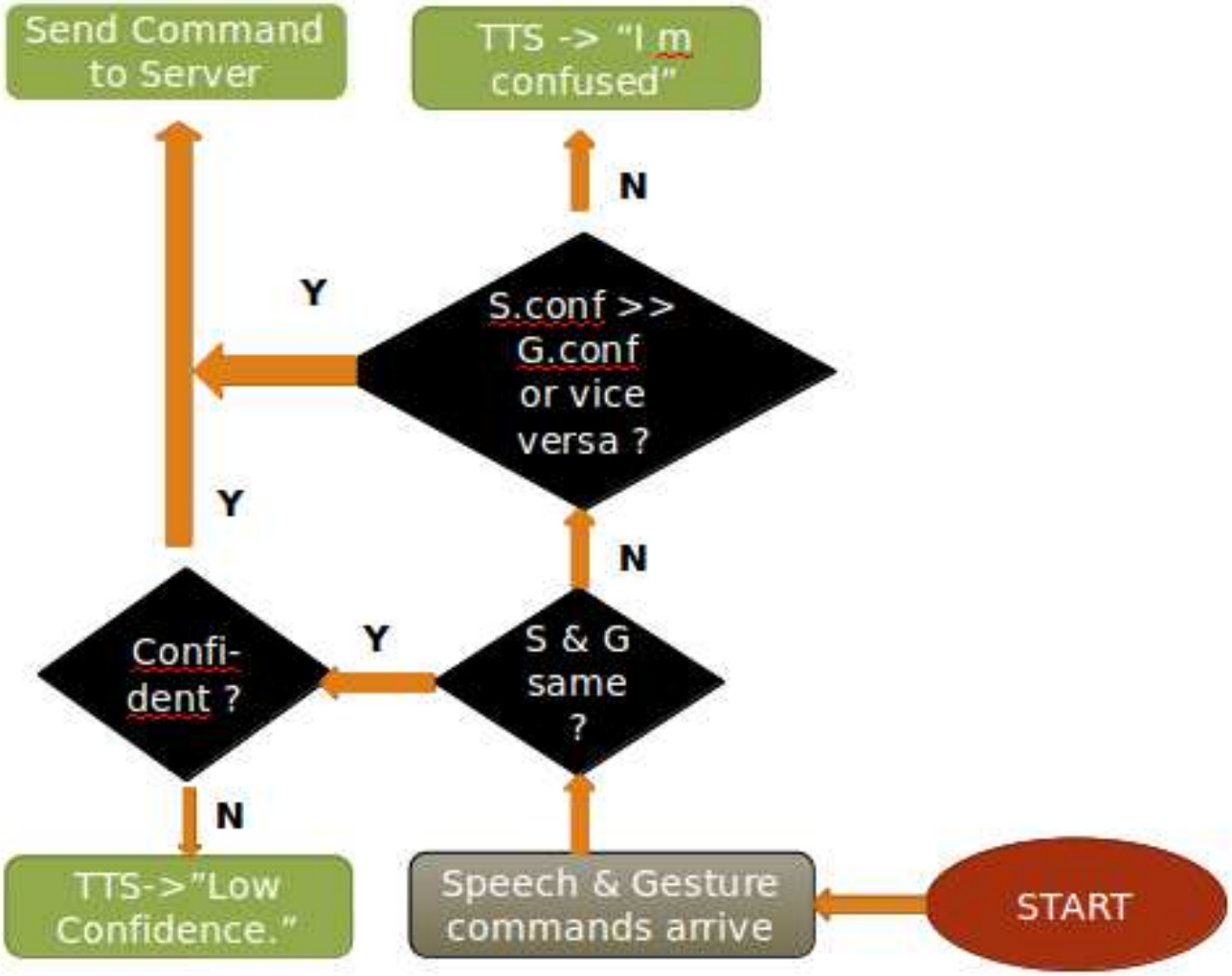


Complementary Integrator

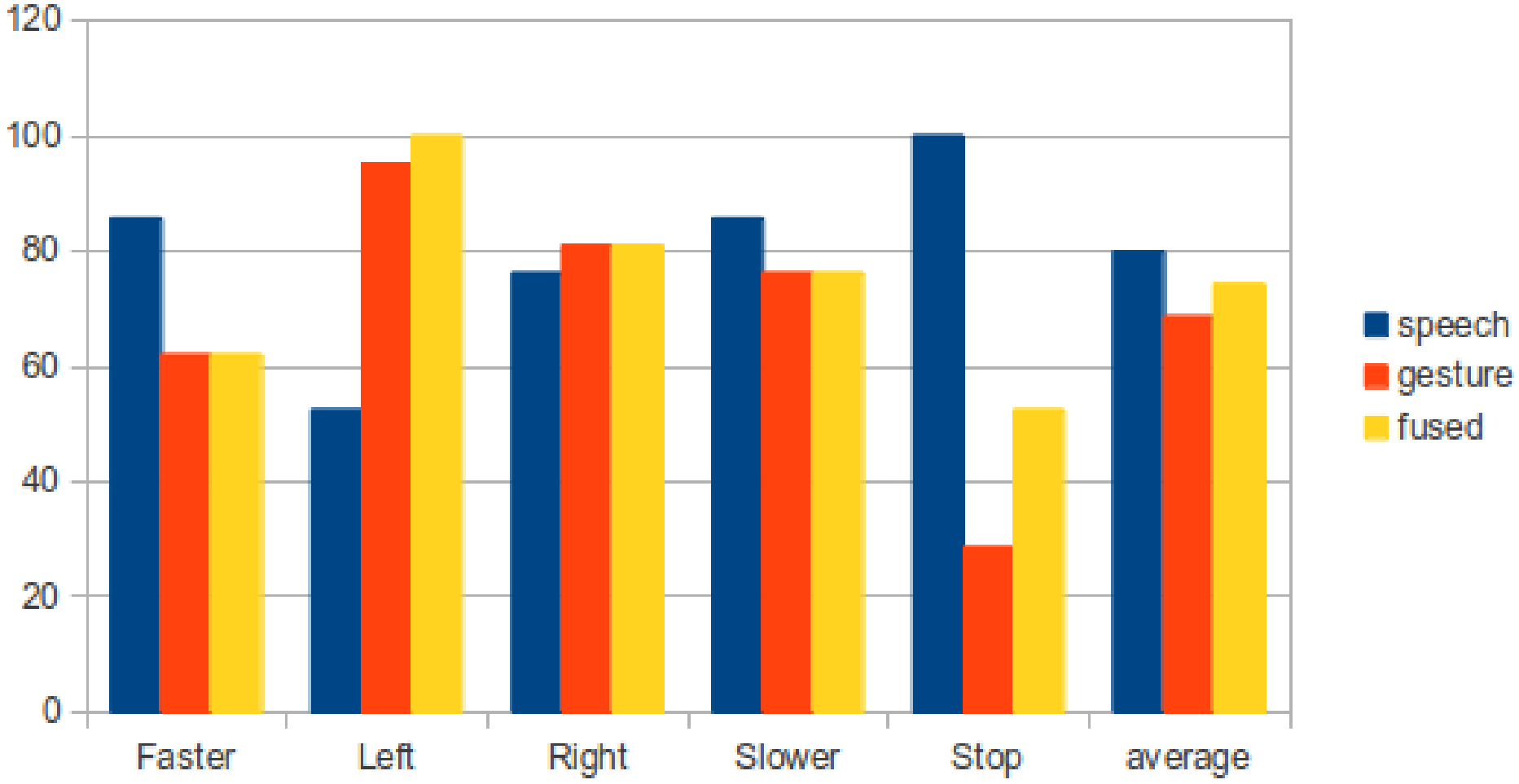




Primary Integrator



Performance analysis



Conclusion

- Successfull use of both speech and gesture to command a robot
- Simple and easy-to-use system : commanding robot motion requiring no world model
- LOCOBOT project (http ://locobot.eu)
- Improvements and on-going work :
  - Gesture recognition : reference training
  - Speech recognition : collaboration with the University of Edinburgh for Distant Speech Recognition
  - Fusion strategy : list merging vs winer-take-all
  - Adding commands, kinect range, noisy environment...

Contact Info

Thank you for your attention !

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