Towards Natural Human-Robot Interaction

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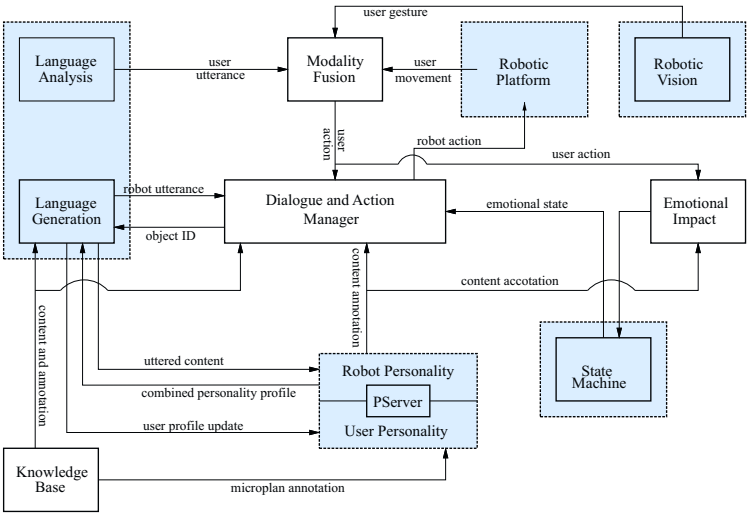
Problem Statement

Here, we present recent developments towards natural human robot interaction. The application at hand involves interaction with autonomous robots installed in public places such as museums and exhibition centers.

To behave and interact naturally, a robot must correctly perceive and understand natural human behavior, as well as act in ways that are familiar to humans. To achieve these goals various enabling technologies across a number of interdisciplinary fields are exploited and advanced:

- State-of-the-art mechanical parts. Robots should be capable of mimicking human emotions and facial expressions, achieving eye contact, and supporting naturalistic spoken conversation.
- Advanced navigation skills. The overall robotic systems should navigate within its environment and act according to motion patterns that are familiar to humans.
- Advanced natural dialogue capabilities. Natural dialogue involves and combines input and output from various modalities, such as spoken natural language, gestures, emotions, and facial expressions.
- Appropriate user models for both for the humans interacting with a robot as well as for the robot itself. User models are used to drive the dialogue management systems.
- Adaptation in the behavior of the robot according to the perceived interests/ background of the interacting person as well as the knowledge, personality and gathered experience of the robot itself.

System Architecture



Timeline

Tourbot
First tour-gude robots installed in museums offering guided tours to real and virtual (over the web visitors)

WebFair
Robotic avartars in exhibitions offering telepresence to remote visitors via the web.

Praxe
Improvemnd in design towards commercialization of tour guide robots

Xenios
Tour guide robots with Natural language interaction capabilities including natural

EMBD Panorama
First permanent installation of tour guide robots in a public place (Museum on Natural History of Crete)

Indigo
Robots with natural increased natural language interaction capabilities

- **2000** Autonomous Navigation
- Interaction with users
- **2001** Control over the web
- Installation real museums
- **2002** Telepresence
- Multple robot support
- **2003** Teleconferencing
- Industrial design
- **2004** Commercialization plans
- Hand gesture recognition
- **2005** Generation of descriptions using natural language
- First permanent installation
- **2006** Industrial design
- Improved dialogue management
- **2007** Natural Language generation
- Natural language interpretation
- **2008** Face gesture recognition
- Fusion from multiple input modalities
- **2009** hardware with impoved animation capanilities
- **2010** User and Robot personality modeling

more to come...

Visual imput/interpretation

On-site demonstrations

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