



Spoken Dialogue Systems for Exploration

Spoken dialogue systems allow a single crew member to control and monitor a large number of complex systems simultaneously. Spoken dialogue interfaces to robotic planners, teams of robots, ship systems including IVHM and Caution and Warning, and voice communication systems will allow safe operation with increased situational awareness covering the essential elements of daily exploration operations.

Background

Natural spoken interfaces to complex Exploration systems will be necessary to allow a limited crew to take over decision responsibility for day to day operations. This will allow a smaller support team on the ground and yet assure safety and control of all of the important systems.

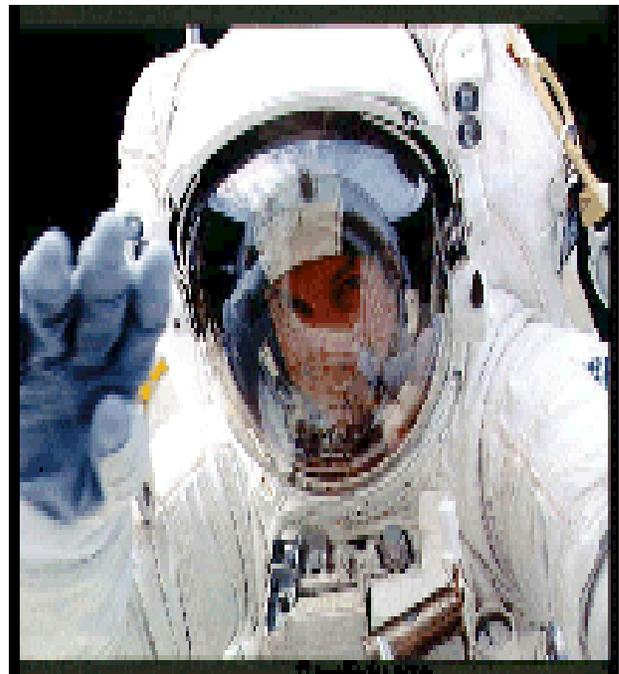
Particular application areas involving spoken dialogue interfaces for in space assembly include:

- EVA support and empowerment
- close collaborative interaction between humans and robots
- decision capture from conversations at Mission Control
- CEV management including inventory, communications, consumables and life support

In order to accomplish these goals the dialogue system will have to participate in human like interactions by:

- knowing when it is being addressed
- using the same familiar methods which human use for misunderstanding repair
- asking clarification questions
- allowing normal pronoun references (it, they, we)
- talking about the future
- working well in noisy environments
- allowing many ways of expressing the same thing,

We believe to do this the system will have to incorporate advanced natural language processing, which uses parsing and semantic processing to allow semi-automatic training of new grammars and semantic analysis, using Explanation Based Learning and Support Vector Machine discrimination. With a limited amount of transcribed speech it is possible to generate a dialogue system, which continually improves as it is used.



Several systems have been built by the RIALIST Group which incorporate this type of processing, the PSA spoken command system, the Clarissa procedure navigator and reader, the EVITA spoken dialogue mission helper and virtual capcom used in the Mobile agents project.

Research Overview

The goal of the RIALIST Team is to produce spoken dialogue interfaces to intelligent agents which can assist the astronauts in a variety of ways to multiply their effectiveness. We have proposed a series of astronaut assistants including:

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Evita (EVA Virtual Intelligent Task Associate) has the following potential tasks:

- plan and timeline management
 - surface navigation in real time
 - robot commanding
 - monitoring life support and consumables
 - controlling cameras and displays
 - superimpose drawings on equipment
 - VR preview of activities
 - read and navigate EVA procedures
 - assembly aids and diagnostics
 - tool and assembly parts locator

Of these the first three have been demonstrated in the Mobil Agents project.

Virtual intelligent crew task assistants operate inside the vehicles and habitats to help with important areas of expertise. Presently we are planning to implement:

- eAssistant
 - scheduling, meetings and communication
 - arranging meetings and appointments
- eMedic Associate
 - monitor health,
 - diagnosis in medical emergencies,
 - medical exam data collection
 - medical treatment procedures
- eMechanic Associate
 - procedures and checklists for repair
 - diagnostics and health management (IVHM)

utterances.

The noise in the ISS and an EVA suit can be loud, consisting of fan noise, airflow, pumps and other equipment. Clarissa has been tested by filling an auditorium with recorded ISS noise accurate in one octave power levels to 37 subjects using active noise canceling microphones and headsets. Clarissa has only a small increase in error rate even in the loudest area, the Russian Service Module.

Flight Ready:

Clarissa has been developed and tested for deployment on the ISS. It is at a TRL level of 7.

Relevance to Exploration Systems

Conversational astronaut assistants will allow fewer crew members and fewer ground personnel to do an exploration mission with improved safety and situational awareness. For exploration the ability to self sufficiently solve problems and effect repairs becomes very important for long term missions where 24/7 ground support becomes difficult and expensive.

H&RT Program Elements:

This research capability supports the following H&RT program /elements:

ASTP/Software, Intelligent Systems & Modeling

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This allows the system to reject speech which is not intended for it. In tests with conversational speech, the Clarissa system rejects 96 % of the out of domain

