SRS

Multi-Role Shadow Robotic System for Independent Living

Small or medium scale focused research project (STREP)

Contract number :	247772
Project acronym :	SRS
Project title :	Multi-Role Shadow Robotic System for Independent Living

ISER-BAS IMPLEMENTATION PLAN

(SRS User Interface - Robot Communication Design)

The SRS project was funded by the European Commission under the 7th Framework Programme (FP7) – Challenges 7: Independent living, inclusion and Governance

Coordinator: Cardiff University

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SRS Interface and Communication Concept Description

1. Introduction

The primary goal of user interface design and communication layer structure is to provide an intuitive, user friendly, safe and network bandwidth optimized access to the Care-o-Bot robot system.

The interface and corresponding communication layers consists of 6 main components:

- **Mapping & Navigation** - Visualize working environment map and robot footprint position
- **Robot Feedback** - Provide information in real-time about current robot status (power data, health & diagnostic information), status and completion of user invoked tasks and etc.
- **Robot Actions Control** - Allow the user to execute common tasks as: direct robot control, navigation aided move to desired map position, grasp objects, and execute more complex actions as get milk and etc.
- **Video Transport** – Visualize robot camera feeds and recognized objects boundaries
- **3D models and point cloud data visualization** (reserved for professional interface)
- **User authentication and tracking** – Manage user access and provides feedback information

2. Software and communication design objectives

- Maximum flexibility and future multiplatform portability of the design concept.
- Bandwidth optimization - to be fast enough for near real time operation or most common available internet connections.
- Build on ROS concept and optimal reuse of existing framework
- User friendly, intuitive user interaction with the Care-O-Bot system

3. Data channels used in the interface

3.1. Control and Feedback communication

3.1.1. Robot position data & Navigation information -
Feeds with data from the robot navigation stack to extract the robot position and footprint.
3.1.2. Robot state -
Reads the corresponding ROS topics to visualize the robot operation state
3.1.3. Robot power information –
Provides the robot current power state.
3.1.4. Other sensor data -
To be specified, what else would be useful sensor information to be displayed on the user interface

3.2. Robot Task Command Interface

3.2.1. Interface to the COB script server -
Allows Action/Task planning, execution and status information via the cob_script_server and action lib stacks
3.2.2. Robot manipulation in direct mode (via joystick interface)
Allows direct robot manipulation from the operator via the joystick interface

3.3. Mapping and Object data

3.3.1. Map data
3.3.2. Interface to the Object database and available actions

3.4. **Video information feed**

3.4.1. Video stream from the robot camera
3.4.2. Recognized Object Highlighting

3.5. **3D data feed** (reserved for professional interface)

4. Communication Medium Protocols

4.1. Control & Feedback protocol – TCP/IP Websockets via the ROSbridge stack

4.2. Robot command interface – TCP/IP Websockets via the ROSbridge stack

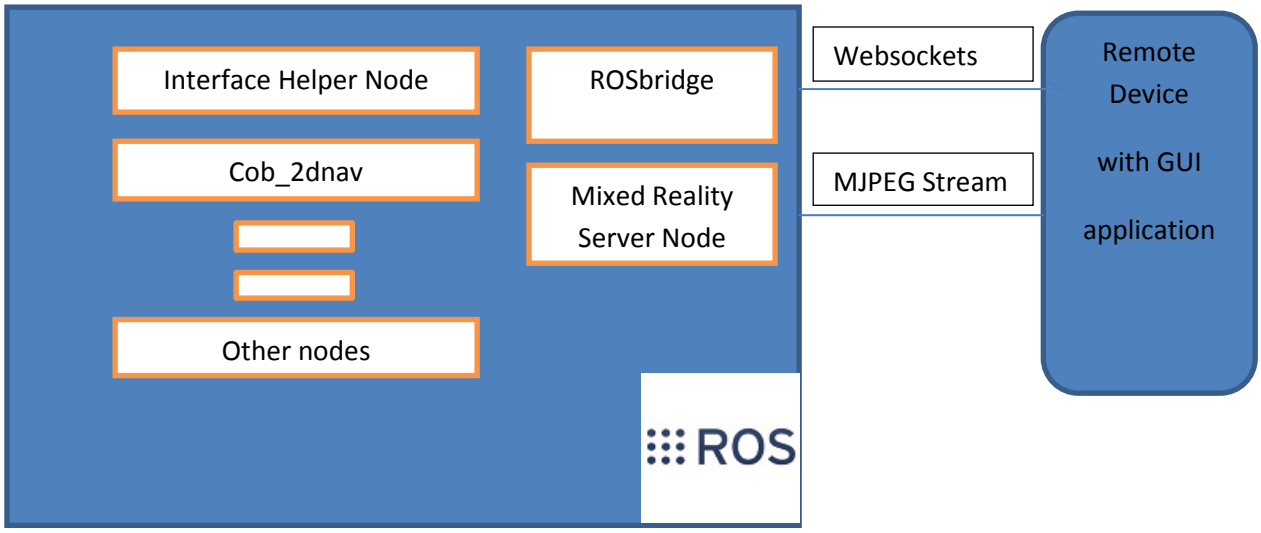
4.3. Video information – TCP/IP sockets provided by custom built by BAS Mixed Reality Server stack, based on the MJPEG stream server available on ROS.

4.4. Map data – Image based feed of map information

4.5. 3D data – to be specified (reserved for professional interface)

5. ROS Intercommunication

For the purpose of the interface compatibility and code reuse for different robotic platforms the interface subsystem is consisted from the following components:



5.1. Interface helper (IH) node – provides interconnection between ROS and some of the user interface functions

Available topics

/cob_interface_status_msg

/cob_interface_map_clicked_pos

/cob_interface_object_selected

/cob_interface_action_selected

/cob_interface_pointer_pos

/cob_interface_command

/cob_interface_connected_users

/cob_interface_object_manage

5.2. Mixed reality server (MRS) node – manages video data

5.3. Graphics User interface (GUI) – framework executed on the remote user terminal device (IOS, Android, Linux, other)

6. Current project implementation plan and status:

Task/Subtask No.	Task description	Subtask	Developer	Current State
Task 1.1	Graphics user interface for IPad	Basic Application programming and interface implementation	BAS	Completed
Task 1.2	Graphics user interface for IPad	Direct robot manipulation via joystick	BAS	Completed
Task 1.3	Graphics user interface for IPad	Map and robot position/footprint visualization	BAS	Work in progress
Task 1.4.	Graphics user interface for IPad	Move robot by selecting of a map point by the user	BAS	Work in progress
Task 1.5.	Graphics user interface for IPad	Available actions list. Tasks execution	BAS	Work in progress
Task 1.6.	Graphics user interface for IPad	COB status, power state and error reporting and visialization	BAS	Work in progress
Task 1.7.	Graphics user interface for IPad	Recognized Objects List visualization	BAS	TBD
Task 1.8.	Graphics user interface for IPad	Mixed Reality Server video stream visualization	BAS	Final phase
Task 2.1	Mixed Reality Server	ROS Image topics MJPEG Streaming	BAS	Completed
Task 2.2	Mixed Reality Server	Recognized Objects Highlighting	BAS	Final phase
Task 2.3	Mixed Reality Server	Connection with Object recognition database	BAS	Work in progress
Task 2.4.	GUI/MRS	Object point and Selection	BAS	TBD
Task 3.	Interface Helper Node		BAS	Work in progress