ICE Telescope
–
A ROS package

Biel Artigues Aguilo

December 10, 2015
Version 0.1.1

Abstract

ice_telescope is a ROS package to operate and remote control the telescope system at the ICE building in the UAB Campus. The full system is composed of a Meade LX200GPS telescope, an SBIG ST-7 CCD camera and a Baader Planetarium dome.

1 Synopsis

ROS
roscore
Server
rosrun ice_telescope ice_telescope_node
Client
rosrun ice_telescope ice_telescope_node action [**params**]

2 Description

ice_telescope is composed of several nodes –*ice_telescope_node*– that allow the control of the telescope system. In addition to the server to control all devices *ice_tel_server*, each of the system components (telescope, dome, ccd) has a pair of client–server nodes following the naming convention *brand_server* and *brand_client*:

Full-Server	*ice_tel_server.*
Telescope	*meade_server* and *meade_client.*
CCD	*sbig_server* and *sbig_client.*
Dome	*baader_server* and *baader_client.*

Note: The *brand_server* servers are there for your convenience but only the *ice_tel_server* is necessary to control them all.

The server node runs continuously waiting for petitions from the client node. When a client node's petition is received by the server node, the server processes the petition, sends a response back to the client and returns to the waiting mode. The client waits for the server response and finishes the execution.

Client node
The **action** parameter issues the desired order to the server.

[**params**] will depend on the system component and the selected **action**.

Note: *roscore* must be running at all times for node communication and interoperation.

3 Servers

The servers for all the system elements are executed without additional parameters and they must be running to listen to the clients commands.

Full-Server

```
rosrun ice_telescope ice_tel_server
```

Telescope

```
rosrun ice_telescope meade_server
```

CCD

```
rosrun ice_telescope sbig_server
```

Dome

```
rosrun ice_telescope baader_server
```

4 Telescope client

The telescope client issues the user's desired actions to perform with the Meade LX200GPS Telescope.

```
rosrun ice_telescope meade_client action [params]
rosrun ice_telescope meade_client.py action [params]
```

Note: To run more than one *meade_client* node at the same time it is necessary to specify a name for the node in the above commands as follows [**__name:=DesiredName**]

4.1 Options

The *action* parameter is the command to be sent to the server. The *action* can be one of the following:

goto Point the telescope to the specified coordinates.

```
rosrun ice_telescope meade_client goto ra dec
```

- **ra** Right ascension as a double value.
- **dec** Declination as a double value.

messier
star
deepsky Point the telescope to the selected catalog object.

```
rosrun ice_telescope meade_client messier objectNum
rosrun ice_telescope meade_client star objectNum
rosrun ice_telescope meade_client deepsky objectNum
```

- **objectNum** The catalog number for the desired object.

gps Update the system's gps. **Note:** The dome must be open for the gps sync.

```
rosrun ice_telescope meade_client gps
```

getobjradec Get the coordinates of the currently selected object.

```
rosrun ice_telescope meade_client getobjradec
```

gettelradec Get the telescope's current pointing coordinates.

rosrun ice_telescope meade_client gettelradec

getdatetime Get the telescope's current date and time.

rosrun ice_telescope meade_client getdatetime

setdatetime Set the telescope's date and time to the current ones.

rosrun ice_telescope meade_client setdatetime

getlatlon Get the telescope's latitude and longitude.

rosrun ice_telescope meade_client getlatlon

setlatlon Set the telescope's latitude and longitude.

rosrun ice_telescope meade_client setlatlon lat lon

- **lat** The current latitude as a double value.
- **lon** The current longitude as a double value.

focus Move the telescope's focus (in/out). WORK IN PROGRESS.

reconnect Re-establish telescope connection.

rosrun ice_telescope meade_client reconnect

5 CCD client

The CCD client issues the user's desired actions to perform with the SBIG ST-7 CCD.

rosrun ice_telescope sbig_client action [**params**]
rosrun ice_telescope sbig_client.py action [**params**]

Note: To run more than one *sbig_client* node at the same time it is necessary to specify a name for the node in the above commands as follows [**__name:=DesiredName**]

5.1 Options

The *action* parameter is the command to be sent to the server. The *action* can be one of the following:

capture Start an exposure and save the result to file.

rosrun ice_telescope sbig_client capture filePath fileType imgCount imgType expTime readoutMode top left width height fastReadout dualReadoutChannel

- **filePath**: The path for the saved image files.
- **fileType**: FITS or SBIG file formats.
- **imgCount**: Number of exposures to take.
- **imgType**: LF (light frame) or DF (dark frame).
- **expTime**: Number of seconds (or fraction of second) of exposure.
- **readoutMode**: Binning. Options: 1x1, 2x2, 3x3.
- **top**: Starting position in the 'Y' axis.
- **left**: Starting position in the 'X' axis.
- **width**: Image width in pixels.

- **height**: Image height in pixels.

  Note: If all params (top, left, width and height) are zero, the full size of the CCD image is used.

- **fastReadout**: 1 for fast readout and 0 for normal readout.
- **dualReadoutChannel**: 1 for dual channel readout an 0 for single channel readout.

settemp Enable or disable the cooler to achieve the desired temperature for the CCD.

rosrun ice_telescope sbig_client settemp enable temperature

- **enable**: 1 to enable and 0 to disable.
- **temperature**: double value with the desired temperature

gettemp Query the CCD temperature. The server returns the temperature, the power applied to the CCD as a percentage (0-1) and the cooler status (enabled/disabled).

rosrun ice_telescope sbig_client gettemp

getcapstatus Query the CCD capture status. The server returns the exposure progress percentage or the IDLE status.

rosrun ice_telescope sbig_client getcapstatus

reconnect Re-establish CCD connection.

rosrun ice_telescope sbig_client reconnect

6 Dome client

The dome client issues the user's desired actions to perform with the Baader Planetarium Dome.

rosrun ice_telescope baader_client action
rosrun ice_telescope baader_client.py action

Note: To run more than one *baader_client* node at the same time it is necessary to specify a name for the node in the above commands as follows [**__name:=DesiredName**]

6.1 Options

The *action* parameter is the command to be sent to the server. The *action* can be one of the following:

open Open the dome.

rosrun ice_telescope baader_client open

close Close the dome.

rosrun ice_telescope baader_client close

status Query the dome status. The possible states for the dome are: open, closed, moving and unknown.

rosrun ice_telescope baader_client status

reconnect Re-establish dome connection.

rosrun ice_telescope baader_client reconnect

7 Files

`ice_tel_server`	C++ implementation of the server to control all devices.
`meade_server`	C++ implementation of the telescope server.
`meade_client`	C++ implementation of the telescope client.
`meade_client.py`	Python implementation for the telescope client.
`sbig_server`	C++ implementation of the CCD server.
`sbig_client`	C++ implementation of the CCD client.
`sbig_client.py`	Python implementation for the CCD client.
`baader_server`	C++ implementation of the dome server.
`baader_client`	C++ implementation of the dome client.
`baader_client.py`	Python implementation for the dome client.

8 Example

```
$ roscore &

$ rosrun ice_telescope ice_tel_server &

$ rosrun ice_telescope baader_client open
$ rosrun ice_telescope sbig_client settemp 1 10.0
$ rosrun ice_telescope meade_client gps
$ rosrun ice_telescope meade_client setdatetime
$ rosrun ice_telescope meade_client messier 31
$ rosrun ice_telescope sbig_client capture /img/ FITS 10 LF 30.0 1x1 0
    0 0 0 1 1
$ rosrun ice_telescope baader_client close
```

9 See Also

ROS, *rosrun*, *roscd*, *rosls*, *catkin_make*.

10 Requirements

ROS Environment *ice_telescope* requires ROS version >= 1.11.13 (>= Indigo distribution).

ROS Workspace If you want to compile or install the distributed system, you need a *catkin* workspace.

Libraries :

- **libusb-1.0**.
- **cfitsio**.
- **libsbigudrv**. This library can be downloaded from `http://archive.sbig.com/sbwhtmls/devswframe.htm`.

11 Changes

Please check the file `CHANGELOG` for the list of changes and acknowledgment to people contributing bugfixes or enhancements.

12 Version

Version: 0.1.1 of December 10, 2015.

13 License and Copyright

The actual version of *ice_telescope* may be found on the following link
`https://baiels.redkaos.org/index.php/s/H4i9a87jyLQ4BMc`.

14 Author

Biel Artigues Aguilo
Email: `artigues@ice.cat`
Web: `http://www.ice.csic.es/`.