ICE Telescope

–

A ROS package

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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**]

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   Point the telescope to the selected catalog object.
star   *rosrun ice_telescope meade_client messier objectNum*
deepsky   *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.

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**]

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

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

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

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

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13 License and Copyright

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

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