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, a SBIG ST-7 CCD camera, a Baader Planetarium dome, an APC Switched PDU and a Vaisala weather station..

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, pdu, weather station) 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.*
PDU	*apc_server* and *apc_client.*
WS	*vaisala_server* and *vaisala_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 nodes. 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 server for all the system elements is executed without additional parameters and it 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
PDU
rosrun ice_telescope apc_server
WS
rosrun ice_telescope vaisala_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**]

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.

park Slew the telescope to the parked position. **Note:** after parking, a power cycle is required.

```
rosrun ice_telescope meade_client park
```

status Check if the telescope is moving or IDLE.

```
rosrun ice_telescope meade_client status
```

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**]

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

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 PDU client

The PDU client issues the user's desired actions to perform with the APC Switched PDU.

rosrun ice_telescope apc_client action device

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

7.1 Options

The *action* parameter is the command to be sent to the server and the *device* parameter specifies on which system element the action has to be performed. The *device* parameter can be one of the following:

telescope The specified *action* will be performed on the telescope.

rosrun ice_telescope apc_client action telescope

ccd The specified *action* will be performed on the CCD.

rosrun ice_telescope apc_client action ccd

vaisala The specified *action* will be performed on the weather station.

rosrun ice_telescope apc_client action vaisala

light The specified *action* will be performed on the light inside the dome.

rosrun ice_telescope apc_client action light

The *action* can be one of the following:

power_on Power on the specified device by switching on the corresponding outlet of the PDU.

rosrun ice_telescope apc_client power_on device

power_off Power off the specified device by switching off the corresponding outlet of the PDU.

rosrun ice_telescope apc_client power_off device

power_status Check the corresponding PDU's outlet status.

rosrun ice_telescope apc_client power_status device

8 Weather Station client

The weather station client issues the user's desired actions to perform with the Vaisala weather station. The only action for the weather station is *getinfo*.

rosrun ice_telescope vaisala_client getinfo

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

9 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
```

10 See Also

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

11 Requirements

ROS Environment *ice_telescope* requires ROS version >= 1.11.16 (>= Indigo distribution).

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

Libraries :

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

12 Changes

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

13 Version

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14 License and Copyright

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