icPoint
Interactive Night Sky Observation

User guide

Contents

1. Introduction

This handbook contains important information about *icPoint* system. It gives explicit installation, configuration and user guide for the products which overcome the boundary of communication methods between human and computer (user-computer interface). The first part describes the system *icPoint* as a whole briefly, introducing its basic classification in web and client application.

Detailed instructions for the installation and use of main application situated in the transmission computer of the user are mentioned in the third part. Section four provides the complex server side manual of the products that are not only appropriate for normal users but also for system administrator.

1.1. Abbreviations

Abbreviation	Meaning
IP	The Address of an internet protocol consisting of 4 or 6 numbers (according to the version) which helps to identify the computers in the network.
URL	The textual address that serves for the identification of servers in the network. The most popular are URL of HTTP protocol.
USB	Unversal serial bus that serves as an interface for the communication of a computer with external devices.
WWW	World Wide Web, Internet

2. System description

icPoint is an astronomical system for amateur observers of the celestial sphere. The basic idea is that the turned head of a user gives the direction of his view. Its name makes clear about its complete functionality – according to English pronunciation, the word icPoint means "*I see point*". If "*c*" in *icPoint* is understood as an abbreviation for *control*, the meaning switches to "*I control point*". The point which user sees is typically the red point from laser device placed on his head (see Fig. 1). The movement of the point in space around him is shown by the turned head.
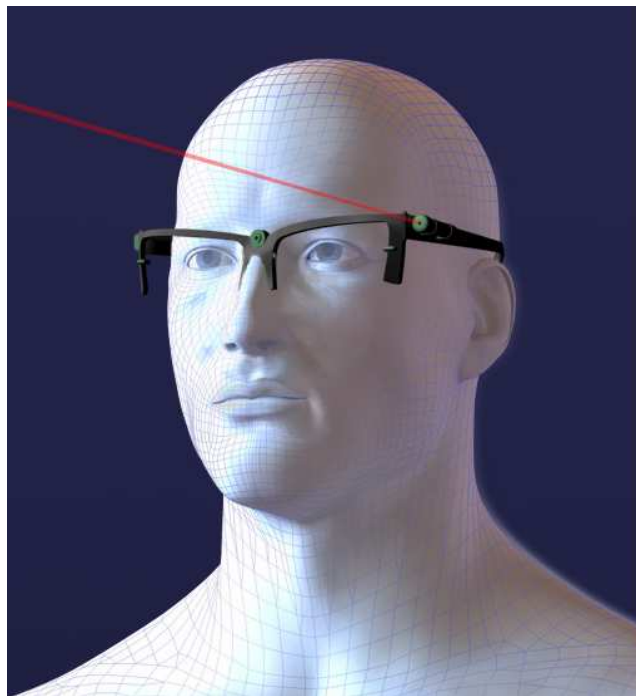

Fig. 1. Laser pointer on user's head

The main part of the product is installed in the portable computer (laptop) that is connected to the web camera which assists to locate the point from the laser pointer. When looking through the window, glass plate over the conference table or other transparent material, the *icPoint* system recognizes the direction of view and provides the multimedia information about celestial item (star, planet, or constellation) that is being observed. It enables to sort out the scientific data or information about every sky object visible to our naked eyes. The comfort in handling the application is increased specially with the help of spoken orders and using special method for controlling the mouse cursor using the laser pointer. In-depth instruction for the installation and usage of the application is mentioned in the third section.

First-of-all, *icPoint* enables everyone to learn about the celestial bodies easy. The system developers realized that nobody has complete and unique technique to guarantee the latest and the most interesting information about the stars, constellation and planets. Thus, it is left for the community of people to fulfill them using online web part of the icPoint system. Every individual can add the names of sky objects in his/her own language, fill it with the multimedia information of all kinds or group stars to constellation specific to a world culture. Not only varieties of scientific facts, also the myths and legends from around the world may be interesting for users who would like to listen to something new during the observation. The instructions for such activities are included in the section 4.

3. Main application

The main application is the part of the *icPoint* system situated on the client's computer.

3.1. System requirements

3.1.1. Hardware requirements:

- Portable computer (notebook, laptop) with at least:

    o processor 1,6 GHz

    o operation memory 512 MB

    o graphical card supporting DirectX 9.0

    o network card (needed for IP camera)

    o free USB port (needed for Web camera)

- USB camera or IP camera with minimum resolution 640x480. The better cam is the one with longer exposure.

- Laser pointer fixed in frame in headset (in frame of glasses next to right eye)

- Transparent material (glass) and "legs" for its stabilization (conference table with glass surface is easily available at home)

- Compass, spirit-level and GPS receiver may increase the accuracy

3.1.2 Software requirements

- Windows XP / Vista

- .Net framework 2.0

- .Net framework 3.0

- System libraries avicap32.dll, gdi32.dll, user32.dll.

- Microsoft SAPI 5.1

- Microsoft Windows Media Player 11

3.2. System installation

For the installation of the application, insert the CD *icPoint* and double click the file *setup.exe* (the program runs automatically when autorun from the CD-ROM is allowed). Installation begins automatically in your computer. In the end, installator adds a link to *Start/All Programs* and runs the application *icPoint* with standard settings. First thing to do after this is to check the parameters of the camera (see section 3.3).

3.3. Basic settings of the parameters of the camera

This section describes the settings of the camera parameters dependent only on the configuration of the hardware. Press the `Menu` button located to the bottom right part of the screen. Select `Camera properties` from the displayed options (see Fig. 2).
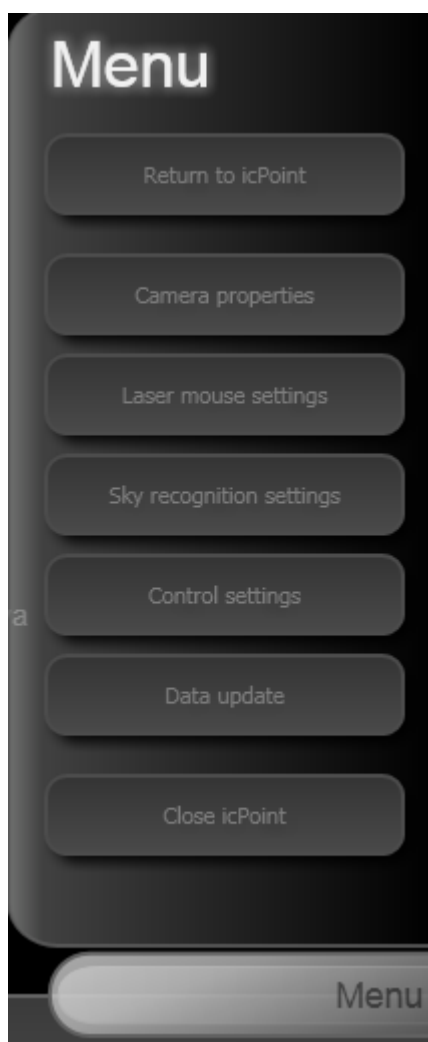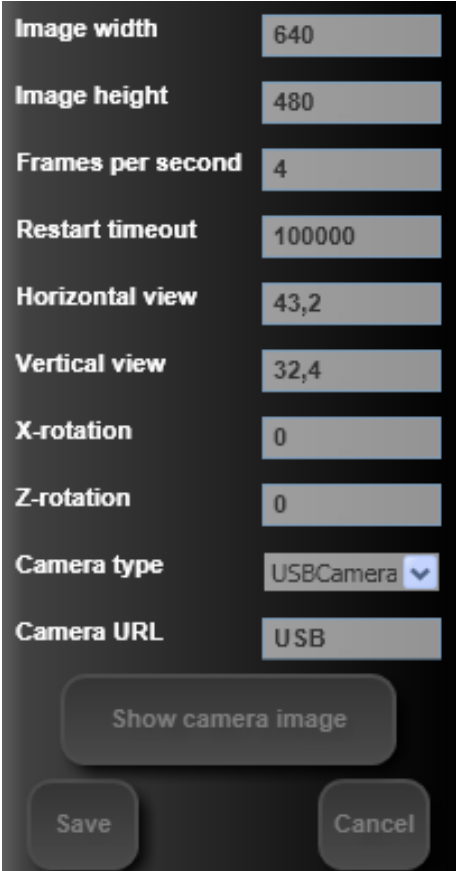

Fig. 2. Application main menu

Window with the settings of the camera get displayed (see Fig. 3). The fields should be filled as follows:

- `Image width` - the maximum picture width provided by the camera. Common values are 640 or 320.

- `Image height` – the maximum picture height provided by the camera. Common values are 640 or 320.

- `Frames per second` - the number of pictures per second requested by the system from the camera. The Bigger the number is, the faster will be the system's reaction to your handling using laser device and also the tracing the new direction of the view to the stars. Very big number on the other hand, demands more pictures from the camera uselessly because the system would not be able to process in real time. As a result, privilege and power of computer will be increased in vain. The recommended interval is from 1 to 10 depending upon the output power of the computer (more powerful the computer, more pictures per second can be processed).

Fig. 3. Camera properties menu

- `Restart timeout` field helps to control the function of the camera. It gives the number of seconds indicating a camera failure – if such time interval expires before another picture comes without any mistake, system tries to restart connection to camera. `Restart timeout` is not commonly used in web cameras (connected using USB) and we suggest you to leave it high (e.g. 10000). It is useful for IP camera.

- `Horizontal view` is for the horizontal view of the cameara which can be found in the documentation of your camera. It is an angle in real world that is captured by the camera to `image width` pixels in the camera picture.

- `Vertical view` is vertical angle of view of the camera which can be found in the documentation of your camera. It is an angle in real world that is captured by the camera to `image height` pixels in the camera picture.

- `X-rotation` and `Z-rotation` fields depend upon the position of the hardware during observation of sky objects, will be explained in **Chyba! Nenašiel sa žiaden zdroj odkazov.**.

- From the combo box `Camera type` select type of the camera that corresponds to your camera the best. For web (USB) camera, good choice is `USBCamera`. It is necessary to choose the format of the video when using IP camera.

- `Camera URL` is used for IP cameras. This field is unused in case an USB camera is connected.

3.4. Prepare for the night sky observation

It is necessary to position hardware used by the system and further to inform the system about that in order to have the complete and absolute knowledge about the stars. The basic positioning is shown in Fig. 4. Take care about the surface you are going to lie on – it can not be reflective, better is rough and dull (even the cement surface reflects rays from the laser device).
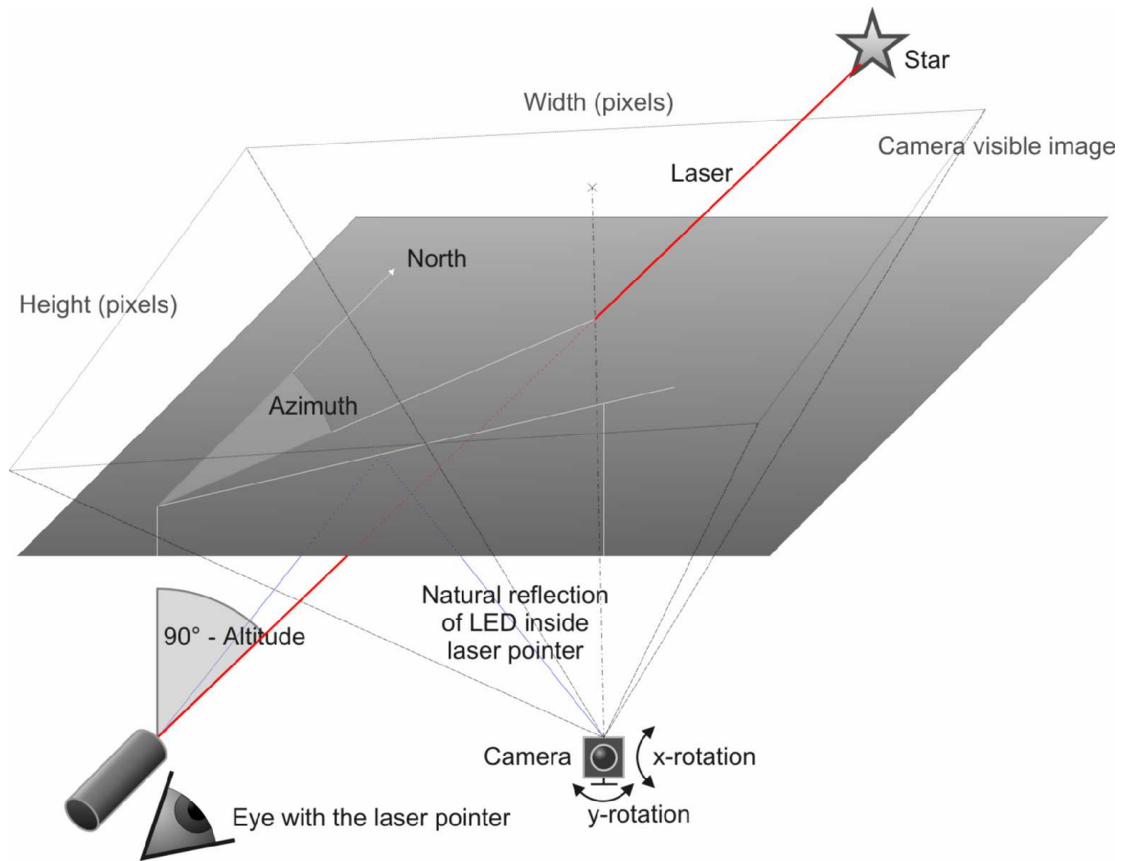
Fig. 4. Basic positioning of the hardware

3.4.1. Rotation of the camera

The first step to recognize the direction of the user's view is to set the inclination of the camera. The rotation of the camera represents the characteristics of the camera and sets in the filed menu (see section 3.3) whereby it is necessary to fill the X-rotation and Z-rotation.

The basis is to rotate the top of the camera image (the y axis) directly towards the North or to rotate it exactly by the Z-rotation degrees. It is recommended to rotate the camera directly to the North and leave the value of Z-rotation to 0. In case it is not possible, it is necessary to measure the rotation and write down the angle in the direction towards the East in degrees (when looking from the top of the camera; see Fig. 5). Compass and protractor might be useful during the measurement.
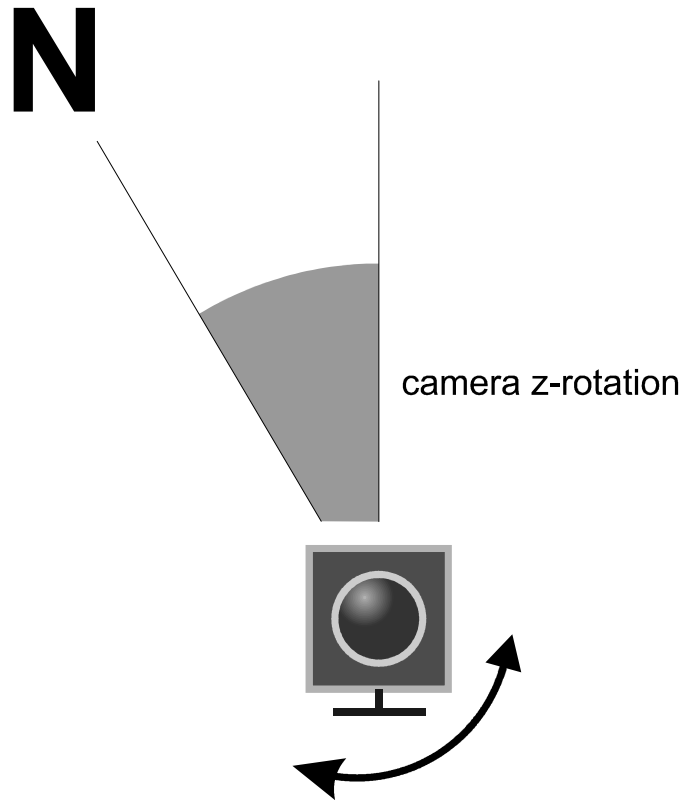
Fig. 5. Rotation of the camera around the Z axis

The gray plane in the Fig. 4 represents the horizontal transparent material through which the celestial objects are seen. Attention should be paid to ensure that the surface is not inclined (it needs to be horizontal; see Fig. 6) – its inclination would result in to impreciseness in determining the direction of the user's sight. Camera is rotated towards the surface so, that it can "see" the part thorough which the user looks (an adequate part from the surface of whole material). Comfortable and the most precise is to point camera to look straight up (in this case, the `X-rotation = 0`) – the disadvantage is that the part of transparent material "seen" by the camera would be small. The effective way to increase the monitored surface is to slightly turn the camera around its x axis (rotating down, respectively up; this is the rotation around the east-west axis in case the `Z-rotation=0`). Remember, that each degree the rotation grows decreases the accuracy of the recognition of direction of user's sight.
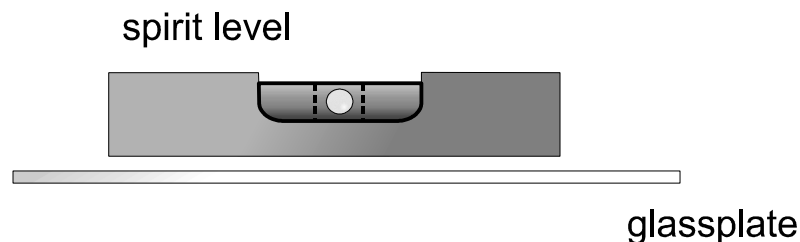
Fig. 6. Horizontal transparent material

Rotation around the x-axis gives the angle of inclination normal to the view of the camera (i.e. directly towards the transparent material) and axis of view from the camera (see Fig. 8). The first option to trace the inclination is to measure it by the protractor. *icPoint* provides also the another easier method using helper window (see Fig. 7) that can be invoked using the `Show camera image` button. Give a light mark on the transparent material so that it can be seen in the center of the image from the camera. Then, measure the horizontal distance of the camera from this point and write it to the field `Horizontal distance`. The vertical distance of the camera from the point (i.e. from the transparent material) write to the field named `Vertical distance`. It does not depend on the unit the distance is given in, but the units used have to be identical. After pressing the button `Save`, the window closes and the system calculates the inclination of the camera and corrects the value of `X-rotation`.
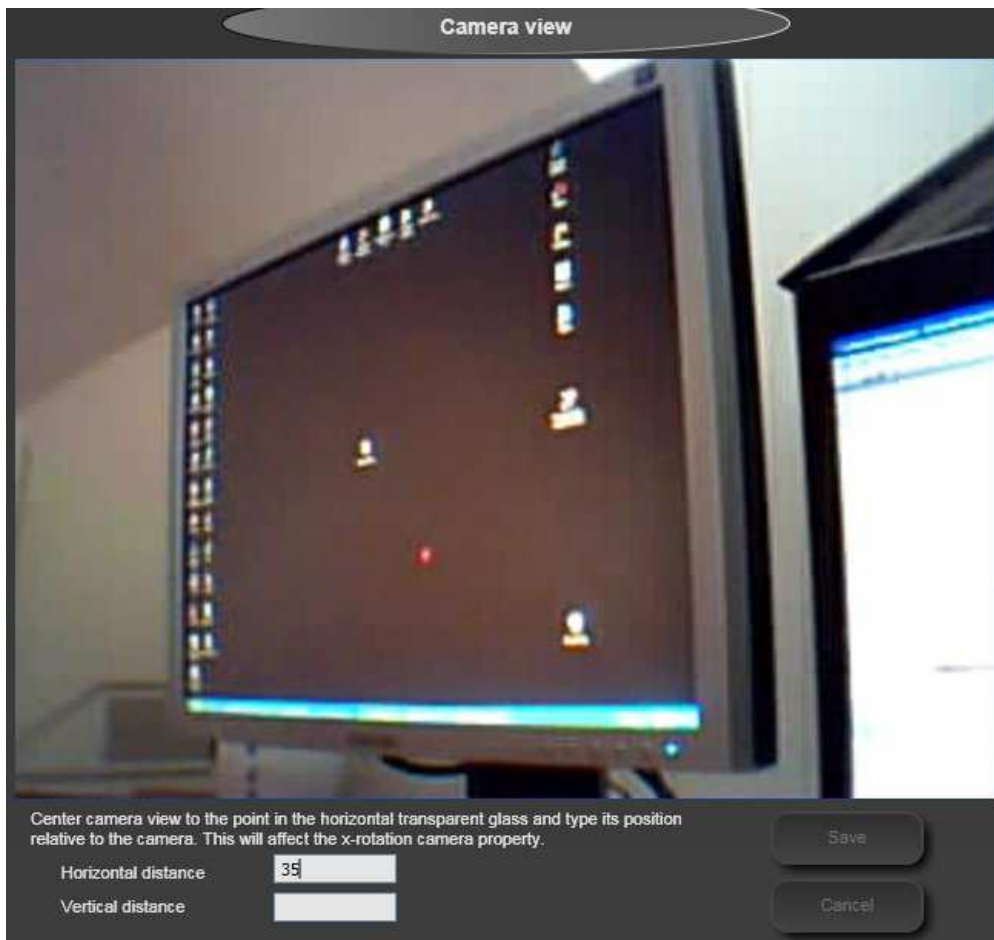
Fig. 7. Picture from a camera
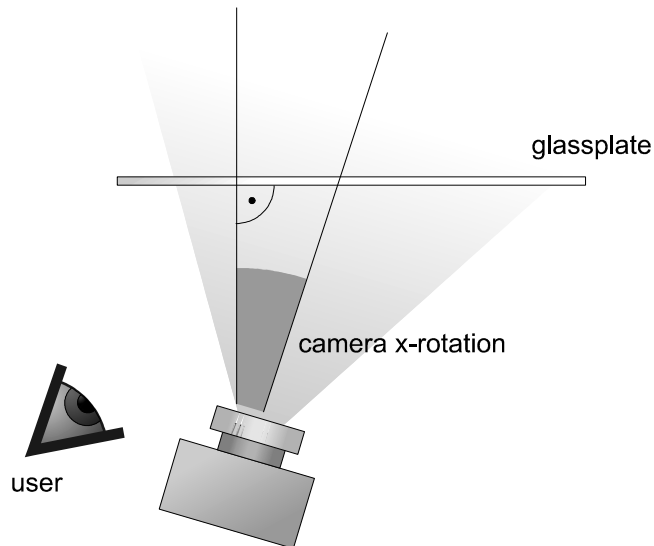
Fig. 8. Rotation of the camera around the X-axis

3.4.2. Sky recognition settings

Open the menu (it is opened by the button `Menu` in the bottom right part of the screen) and selecting `Sky recognition settings` (see Fig. 9).

Fig. 9. Sky recognition settings menu

With the help of two sliders on the top of the window, sensitivity of the observation can be modified. The more is the shift towards the left, the smaller and weaker point the system recognizes in the image. However, this also means more interference as shift moves to

the left, so the direction of observation might keep "jumping" (changing unexpectedly). According to the light conditions and used laser pointer it is necessary to find the combination of these values (shifts), that keep the sliders towards right the most while the system can still recognize in the camera picture the points used to determine the direction. It is recommended to follow the FAQs to find the best combination.

`Laser Color` stays for the color of your laser i.e. the point from it on the glass. Commonly, it is red. If you would like to use pointer that emulates laser of any other color, change this value by clicking on it.

`Reflection color` stays for the color of the point which is formed on the glass as the reflection of natural light rays from laser pointer. It is typically white. `Laser color` and `Reflection color` should be selected in such way that they are in a sharp contrast in case of point substitution during evaluation.

`Run at startup` indicates whether the direction of user's sight is automatically executed when the system starts.

`Is running` indicates whether the service (recognition of user's sight towards sky) is executed. You can change this value turning it on, respectively off. The change takes effect when the `Save` button is pressed.

3.4.3 Geographical position of the observer.

Geographical position of the user can be set in two ways:

- Manually by giving the values of longitude and latitude.

On the bottom of the window are fields `Longitude` and `Latitude` (see Fig. 9). The East geographical distance is given in `Longitude` in degrees and the North geographical distance in `Latitude`. For opposite hemisphere is the value same but negative.

- Using interactive map

The lower part of the menu contains `Observation position` and `Earth map`. Its use requires Internet connection, so do the job already in home.

After pressing the button `Earth map`, a window with an interactive map *Google maps* displays (see Fig. 10). Navigation to a city can be performed using the upper field, where you can give names of the city followed by a comma and an ISO three-letter abbreviation for the county. (e.g. "svk" for Slovakia or "aut" for Austria). After pressing the button `Go!`, map shifts to the selected city. Use the buttons located in the upper right section

to change the map type – street map (`Map`), real world pictures (`Satellite`) or a mixed map (`Hybrid`). The navigation within the map can be done using the controls on the left side of the map. Mark your observation position using the red marker, which can be positioned by left mouse click. The `Save` button calculates the geographic position and sets the new `Longitude` and `Latitude` in the sky recognition settings menu.

Fig. 10. Interactive map

3.5. Prepare for mouse cursor control

Press the `Menu` button located to the bottom right part of the screen. Select `Laser mouse settings` from the displayed options (see Fig. 2). A window is displayed giving the settings of subsystem for controlling the cursor of the mouse using the laser pointer (see Fig. 11).
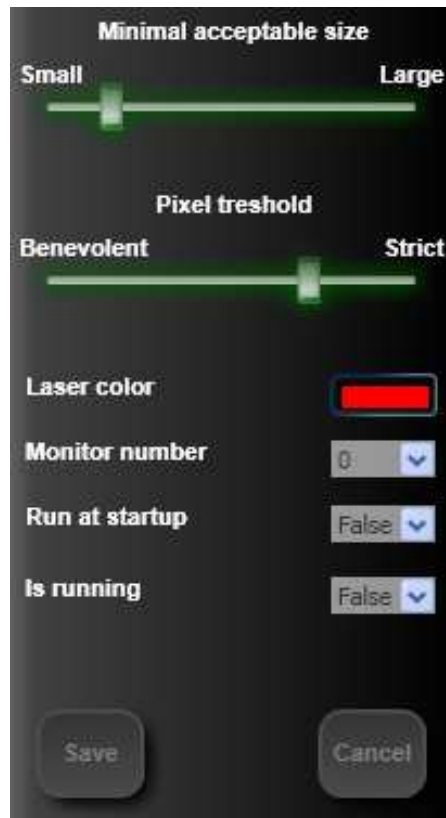
Fig. 11. Laser mouse settings menu

Similar to the settings of recognition points for the user's sight direction (Sky recognition settings, see section 3.4.2), this window contains on its top two sliders for the sensitivity modification. Here it is the sensitivity of searching for point from pointer used to manipulate the mouse cursor position. Also here is truth, that position of shift closer to the left means that the system recognizes smaller and weaker point in the image. However, this also means more interference as shift moves to the left, so the mouse cursor might keep "jumping" (changing position unexpectedly). According to the light conditions and used laser pointer it is necessary to find the combination of these values (shifts), that keep the sliders towards right the most while the system can still recognize in the camera picture the points used to determine the new mouse position. It is recommended to follow the FAQs to find the best combination.

`Laser Color` stays for the color of your laser i.e. the point from it on the glass. Commonly, it is red. If you would like to use pointer that emulates laser of any other color, change this value by clicking on it.

`Monitor number` enables *icPoint* to control mouse cursor also on the other computer displays than the main one. Set the monitor id as it is given by your operating system (Windows) – it is common that 0 stays for the main monitor and 1 for the next one.

`Run at startup` indicates whether the mouse cursor control using the laser pointer is automatically executed when the system starts.

`Is running` indicates whether the service (mouse cursor control using the laser pointer) is executed. You can change this value turning it on, respectively off. The change takes effect when the `Save` button is pressed.

3.6. Control and sky display settings

Press the `Menu` button located to the bottom right part of the screen. Select `Control properties` from the displayed options (see Fig. 2). A window with application control settings and display properties get opened (see Fig. 12).

The first field - `Overall settings` enables you to save all the application settings using a given name. The settings can be loaded later by selecting the name from the combo box list. Use this system feature to predefine some system variants dedicated to specific observation localities.

`Display radius` gives the radius of the observation angle in degrees as it gets displayed on the computer screen. The lower the value of this angle is, the more detailed is the part of the sky shown on the screen. Maximum value is 90 degrees.

`Maximal magnitude` stands for the maximal visibility of sky objects that will be displayed. Magnitude is the physical expression of clarity of the sky objects. The lower the magnitude is, the "more shining" is the object. Magnitude does not have minimum – it is negative for object like Moon, Jupiter, or Sun. A normal healthy eye can see magnitude up to 6, some individuals even 7.5, but in common practice is this value lower. Clarity of view depends especially on whether the observation is in dark part and the sky is clear; or in a dense city full of smog on the other side. To sum this up – if you are at the dark place far away from the lights of modern civilization, set the magnitude to 6. If you are close to the street lamp, your eyes are not the healthiest ones (you are wearing glasses and the vision is not clear) or it is cloudy, set the maximal magnitude to 1 (or even lower). The best result is to achieve situation when the icPoint displays exactly the stars you can see on the night sky at the moment. For common use, maximal magnitude close 4 is suggested.

`Font size` gives the size of font used while writing the names of stars and constellations at displayed night sky.

Select culture of constellations you would like to view at the image of night sky and learn about using the *icPoint* application from the combo box `Culture`.

Fig. 12. Control properties

The combo box `Language` is used to select the language for description of stars and constellations of the night sky.

`Displayed elements` section enables to select what is supposed to appear in the night sky. If the `Star names` field is checked, names of the stars and planets are displayed. `Constellation names` field represents the name of constellation. Finally, the field `Constellation lines` enables to turn on or off the displayed lines of the constellations.

`Current view` section enables user to manually change the direction of the displayed part of the night sky. `Azimuth` is the horizontal rotation from the North and `Altitude` is the vertical rotation from the horizon (both is given in degrees).

The last section of the window serves for the voice control of application.

3.7. Voice Control

icPoint does not require hands to control the system. The list of available voice orders are in table 1. Some last recognized voice commands appear written in the upper left part of screen below the "`selected sky object`" label. Control properties menu (see Fig. 12) is used to switch the voice control on or off. Here, the `Run at startup` field `startup` indicates whether the voice recognition is automatically executed when the system starts. `Is running` indicates whether the voice control is executed when the menu gets opened. You can change this value turning it on, respectively off. The change takes effect when the `Save` button is pressed.

Table 1. Voice commands

Command	Meaning
mouse down	Raises the mouse left button click event.
close application	Ends the application
quit application	
update background	This command is important for correct image recognition. Use it when the hardware is positioned properly and you are not pointing anywhere using the laser pointer (it is turned off). Use F5 key to do the same job.
update display	Redraws the celestial sphere in the application.
update sky	
use current sight	
show stars	
next star	Selects next (further from the center of the screen) sky object.
further star	
previous star	Selects the preceding (closer to the center of the screen) object.
closer star	
show object information	Displays the window containing information about the selected sky objects. (star or planet)
show star information	
show constellation information	Displays the window containing information about the constellation that contains currently selected star
hide information	Closes the window with the information about the sky objects.

increase magnitude	Increases the maximum visible magnitude by 0.5
decrease magnitude	Decreases the maximum visible magnitude by 0.5
increase view angle	Increases the display radius by 5 degrees
decrease view angle	Decreases the display radius by 5 degrees
start sky recognition	Executes the recognition of direction user's sight to stars
stop sky recognition	Stops the recognition of direction user's sight to stars
start mouse recognition	Executes the mouse cursor control
stop mouse recognition	Stops the mouse cursor
select item one ... select item nine	Selects the object 1 – 9 in the window with information about sky objects. Use this command to change selected expandable control (expander) at the same level
select item next	Selects following object in the window with the information about the sky object
select item previous	Selects preceding object in the window with the information about the sky object
select item lower	Selects first object contained within current expander in the window with the information about the sky object
select item upper	Selects first object contained within current expander in the window with the information about the sky object
expand item	Expands (shows its content) current object in the window with the information about the sky object
collapse item	Collapses (hides its content) current object in the window with the information about the sky object
use item link	Uses the link in current object – moves from star to the constellation and vice versa (changes the content of information window)
read item content	Reads the text in current object in the information window
show constellation lines	Displays the constellation lines in the image of night sky.
hide constellation lines	Hides constellation lines in the image of night sky
show star names	Displays the names of the stars in the image of night sky
hide star names	Hides the names of the stars in the image of night sky
show constellation names	Displays the constellation name
hide constellation names	Hides the names of constellations

3.8. Download newer information about sky objects from web

Choosing the field `Data update` in the main menu application (see Fig. 2), will get the focus to the window (see Fig. 13) which enables to set the parameters for updating local database from the remote *icPoint* database situated in Internet.

Fig. 13. Update menu

Check the `Update all local names` field if you wish to update localized names (names in distinct languages) of all celestial spheres and constellation. Check the `Update all constellations` field to update constellations (their culture, list of stars and lines joining the stars visually).

You can set system to update the multimedia data of specific data type without taking care of an object it is bound to in the system. To do this, check the `Update data` field and select desired data type from the combo box. There are following types available: `text` (plain text or HTML pages), `image` (pictures, etc.), `audio` (sound records), `video` (movies) or `all` (everything).

The part of menu named `Constellation` enables the update of the local name and multimedia data bound to one constellation. The `Id` field serves as an identifier of the selected constellation; `Language` stays for the language of local name and multimedia content. Check the `Update local name` field to allow the update of local name and `Update multimedia data` to update the multimedia information bound to the constellation.

The last section of the window relates to the sky objects. Field `Catalogue` is used to specify the catalogue, the given object belongs to („hip" contains stars and "planet" is the name for catalogue of planets). Field `Id` serves as an identifier of the object in the given catalogue. The `Language` field specifies the language of the imported local name and multimedia data. Check the `Update local name` field to allow the update of local name and (similarly as in `Constellation`) `Update multimedia data` to update the multimedia data bound to the object.

After giving the parameters for the update, it is executed by pressing the button `Update`. The progress of update can bee seen in the lower part of the window. Press the `Close` button to return to the previous menu.

3.9. Using the system

At home set the system parameters as mentioned in the preceding section, prepare the necessary hardware and move to the quiet and dark place so as to have clear view of stars while lying down on "non-glistening" surface (suitable place is dry grass).

3.9.1. Determine the direction of sight

When arrived to the observation position, place the hardware and rotate the camera to the transparent material according to the instruction in 3.4.1. Next, turn the sky recognition service (direction of user's sight recognition) on. Lie down comfortably and say "`Update background`" (voice command for the system). If you are going to use the system for a long time, repeat this command once upon a time when you do not pointing the laser pointer to the transparent material. After these initial steps, close your left eye and watch the selected part of the sky with your right eye (the one, you are having the pointer close to). After a while give sound command „`Update sky`", which makes the system use the actual direction of your sight for displaying the appropriate part of night sky that you are currently looking at, together with the marked constellations in chosen culture (see Fig. 14).
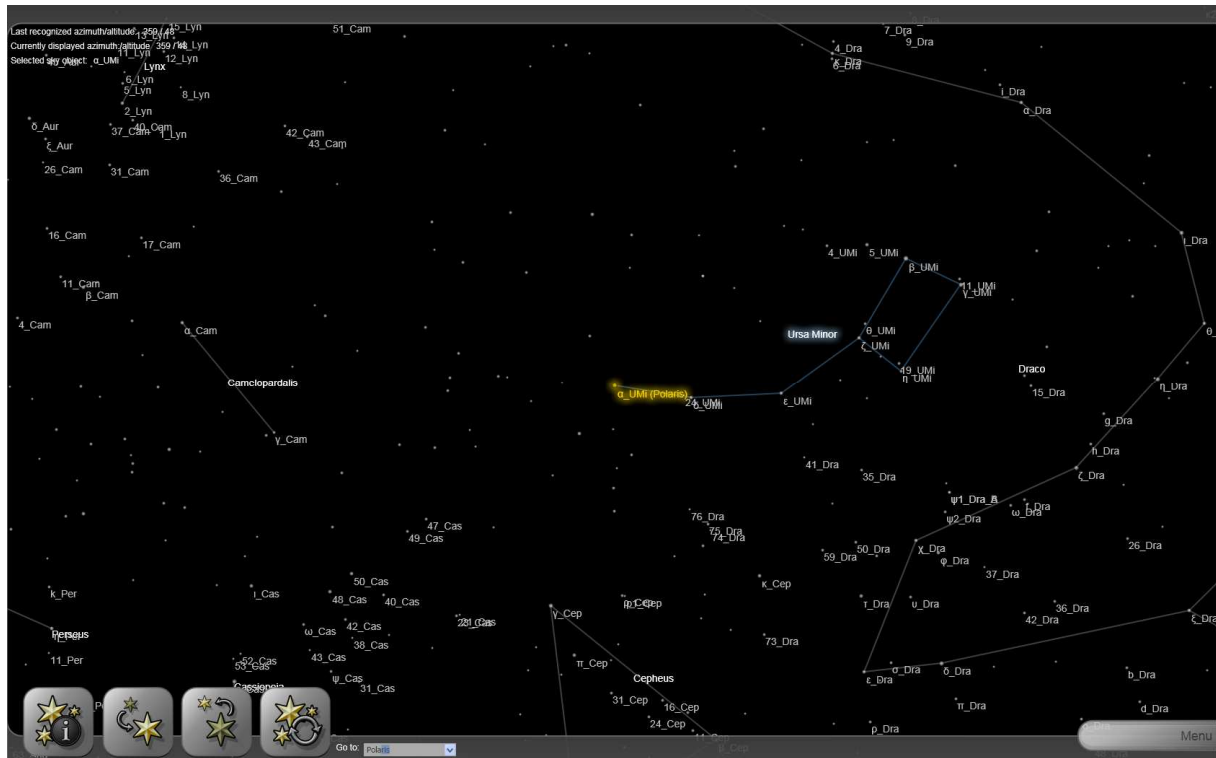
Fig. 14. Night sky displayed by the system

icPoint system enables also the direct search for stars, planets and constellations. The lower part of the screen contains a window that can be used to enter a local name (name in the language you have selected) of a sky object. Push the Enter key to rotate the image of night sky to it. System automatically adds the most probable text (this is the name starting with already given characters at the beginning) while writing the name after each character. Click the right part of this window to get a list of possible alternatives. Besides entering the local name, it is possible to use prefix "hip" (star catalogue) or "planet" (planet catalogue) followed by the identification number (ID) to search the catalogues directly.

3.9.2. Select from displayed sky object

System automatically arranges the sky objects according to their distance from the recognized direction of user's sight and marks the nearest star. You can display the information about the selected object pressing the mouse left button in the lower part of the screen or using voice command „Show object information". The multimedia window (see Fig. 15) appears in the left part of screen. Information about the constellation where the currently selected star belongs can be displayed by voice command "Show constellation information". Opened window can be closed by pressing same button or by saying command "Hide information". To display the information about

other sky objects near the center of the current display, use second or third button in the lower left corner of the screen to navigate to them. You can move in the direction towards the border (voice command „Next star"), respectively to star or planet nearer to the center of the screen („Closer star"). The information displayed in window gets automatically refreshed when the selected sky object changes.
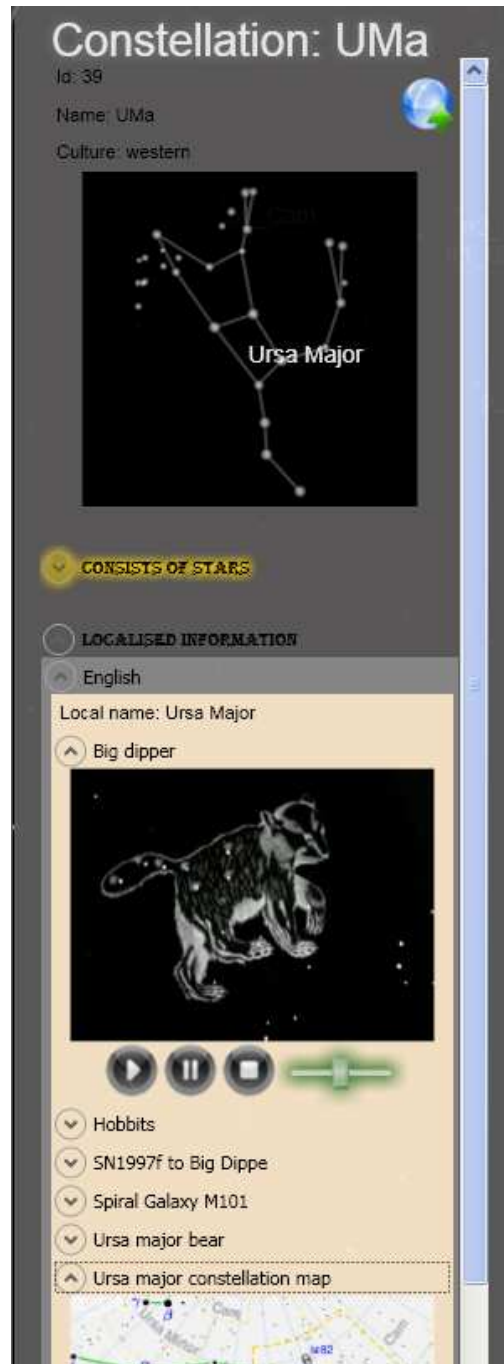

Fig. 15. Window with multimedia information about sky object

3.9.3. Window with information about sky object

Window with the information about sky object is divided into immovable heading and scrollable information. Under heading comes basic information about the selected sky object (planet, star or constellation). Next on this level comes expander with list of connections between stars and constellations and localized multimedia information.

The overview of window with multimedia information about constellation "Ursa major" is in Fig. 15. At the top of window can be seen basic information panel together with image of constellation as it can be seen at the night sky at the moment. Each item in the list of embedded stars within the constellation contains link („Detailed information...") to information about the star. The link can be executed also using voice command "use item link" when it is marked as actual for voice control using yellow outline.

When displaying information about star, the list of constellations per world culture is displayed instead of the list of stars. It provides basic information and link "Detailed information..." to each constellation.

In the Fig. 15 is the first list (list of connections stars-constellations) collapsed, to leave more space for the last part of the window; it is not accessible while displaying information about a planet. Thus, even more interesting might be the second list named Localised information, which stays the same for stars, planets and constellations. It contains textual and multimedia information bound to displayed object, grouped to languages they are specific to. Click the language in which you want to get the multimedia information. It will display the local name of the selected object and list of headings of multimedia information associated with current sky objects (planet, star or constellation). Click the selected heading or say voice command "expand item" if there is a yellow outline around the item (it is selected). System displays desired data – if it is audio or video, it starts playing it. If it is text or image, the system displays it. If it is text, you can let system read it by saying "Read item content" or by clicking the text using your mouse.

It is possible to step from one to another expander (i.e. hide-able and expandable list) selecting it by the yellow outline mentioned above already. To move the selection on the same level use "Select item one", "Select item two", till "Select item nine", or "Select item previous", respectively "Select item next" (see section 3.7). Use command "Expand item" to expand selected expander and

command "Collapse item" to hide its content. To move the selection to the higher level, say "Select item upper" and "Select item lower" to move lower.

3.10. FAQ

Why the transparent material (glass) is needed – isn't it possible to make it somehow else?

Of course, there could be many ways to do the same job. We have focused our attention to invent a method that is based just on common hardware that can be found in many households.

The most frequent opinion is that the solution could be to place the camera on user's head and detect the direction straightforward from the stars, the camera would see. Unfortunately, this is not possible. The problem is that common web camera (the same is for IP cams) is unable to "see" any star. There is simply not enough light from a star coming to the web camera, to make any change in the received image – when you point your web camera to the night sky, it will stay complete dark (black). Solution could be the usage of a reflex camera (this is a problem, while they are far more expensive than a web cam; and it is not possible to use web cam to do the job this way) and set is exposure (time of exposition) to about 10 seconds – this long period is required to let enough light from stars thru the ocular of the camera to get a good image of a night sky. You would have to leave your head directed to a star, you want to learn about, for 10 seconds without any movement (if you move, the image would be blurred and useless) – no one would like to do that.

Therefore our solution uses a web camera (positioned on the ground) in combination with a glass. The transparent material (glass) is used as a plane of projection – here the light emitted by the laser pointer falls and its reflections are monitored by a web camera. The positions of reflections are recognized by the system and the direction of user's sight is evaluated.

Why azimuth always "jumps" when I am looking directly upwards?

There is nothing to worry about. It is very normal phenomenon. The interval of the accuracy of the *icPoint* system moves around 3 degree – i.e. about angular distance on the surface of a sphere. If this altitude is near to 90 degrees, azimuth does not play any role.

It can be imagined as if one is on the North Pole of Earth – to go around the whole Earth means just to make a few steps (i.e. longitude as the equivalent of the azimuth changes

very fast, however your position is not changed very much). To go around the same arc when situated on the Earth's equatorial is not so simple and stays for some thousands of kilometers. So, be satisfied, observation of stars is not affected by this.

What I supposed to do when the laser pointer is turned off but the system still shows new azimuth and height of 0.90?

Give command "Update Background". If it does not help, it is necessary to set the "pixel threshold" value in Sky recognition settings menu more strict (shift the slider towards right).

What is the meaning of "pixel threshold" in menu for the settings the recognition of mouse/sky?

This value is needed when searching for the points in the picture. It is the minimal color change necessary so that a pixel in the picture is marked.

What is the meaning of "minimal acceptable size" in menu for the settings the recognition of mouse/sky?

This value is needed when searching for the points in the picture. It is the minimal size of the area found in the picture necessary to not take it as interference. Interference is common epiphenomenon while acquiring picture from the camera – these are area in the picture which changes without user's choice so has to be filtered automatically

What to do when azimuth and the height changes frequently?

First of all, check the picture from the camera. Verify whether multiple reflections occur or not when the light from the laser pointer fall on the transparent surface. In case of the unsuitable material is being used – very thick glass where reflections can occur more times or you are lying on the very reflective surface. Try to lay carpet under you or lie down on the grass.

If the picture from the camera is alright, try to set the "Pixel threshold" value in the Sky recognition settings menu more strict (shift the slider towards right), or tighten the "minimal acceptable size" (shift the slider towards more right). Don't forget to repeat the command "Update background" at certain interval of time when there is no shine on the surface of transparent material occupied by the camera. This command guarantees that the data about the picture from the camera is correct and helps in filtering the interference.

Is there any help, when the camera is working properly, the system receives images from it, but there can not be seen any reflection of the laser pointer?

Yes, there is. Move yourselves to darker place and check whether the camera can "see" the part of transparent material (glass) you are pointing to using the laser pointer. If it does not help, the problem is the exposure (time of exposition) of the camera. Common web and IP cameras has at least partially configurable exposure – change it to the highest available value (the longer the period is, the more light is received by the camera, so the camera can catch also the weak light ray from the laser pointer). It is suggested to set the exposure to the maximum and to lower the brightness as needed. Detailed instruction can be found in the user guide of your camera.

What to do when the direction of the observation is turned on, also the picture from the camera is OK, but I still do not get any new value for azimuth and altitude?

Check if both the points from laser pointer are visible in the image from camera. In case they are not visible, you need to move yourselves in such a way that you are able to see through the part of the transparent material occupied by the camera. If both points are visible then try to set the recognition parameters less strict - so it can detect smaller points (shift "minimal acceptable size" in the Sky recognition settings menu towards left) or enable more benevolent evaluation of the pixels (shift the "pixel threshold" in the Sky recognition settings menu towards left).

What to do when azimuth is constant but it seems to me as some degrees beyond?

Rotate the camera in such a way that its top surface is towards the North; check whether the inclination of X-rotation is correctly set and if the transparent material is really horizontal. See section 3.4.

What do you mean by white respectively grey colored texts of last calculated azimuth and altitude in the upper left corner of the screen?

White color means that the data are up to date. Color is changed to dark grey when the system is not able to recognize new data about the direction of the user's sight for a longer time.

What to do when cursor of the mouse "jumps" frequently whereby the screen does not contain any areas colored similar to the color of the laser from laser pointer?

Try to set the "pixel threshold" in the Laser mouse settings menu stricter - shift the slider more towards right.

What to do when cursor of the mouse "jumps" frequently whereby the screen contains some small areas colored the same as the laser?

Try to tighten the "Minimal acceptable size" in the Laser mouse settings menu – shift the slider towards right. If the area colored the same as the laser is of equal or even greater size, then the laser will not work correctly till such areas are removed.

What to do when the control of the mouse cursor is turned on, picture is also released from the camera but cursor does not move when I point to the screen with the laser pointer?

Try to let system more benevolent recognition settings – let it recognize small points as well (shift "Minimal acceptable size" in the Laser mouse settings menu more towards left) or enable the benevolent evaluation of pixels (shift the "pixel threshold" in the Laser mouse settings menu more toward left).

3.11. System uninstallation

Open Control Panel (Start / Control Panel) and double click Add or Remove Programs. Select *icPoint* and press the button Change/Remove. A guide is displayed for the system uninstallation.

4. Web application

Important part of the *icPoint* system is web application which enables users to add new information to the system thru the Internet. This information can be scientific – e.g. news, research descriptions, local names, culture specific constellations, or popular content like myths and legends. Any user can download all this data to his/her icPoint application.

To use the web application, connect to the Internet and use your web browser. The application has been tested on Internet Explorer 7, Mozilla Firefox 2.0 and Opera 9.10. Use standard players to view the multimedia content like images, video and audio.

4.1. How to start?

There are some flash animations included on the installation CD (in directory /doc/flash) showing the most popular and the most frequently used functionality and properties of the application interface. The purpose of the animations is to serve as supplement to this guide and they do not cover all the details of the interface. Use the Adobe Shockwave software (tested on version 9) and a web browser to play it. There are 3 animations present on the installation CD:

skyObjectSearch.htm – basic properties of the interface, example of form and navigation, searching for sky objects.

addLocName.htm – adding of local name to a constellation and a sky object, example of editing existing names.

addMultimedia.htm – adding multimedia information to a sky object, example of error message, editing the multimedia information and displaying its history.
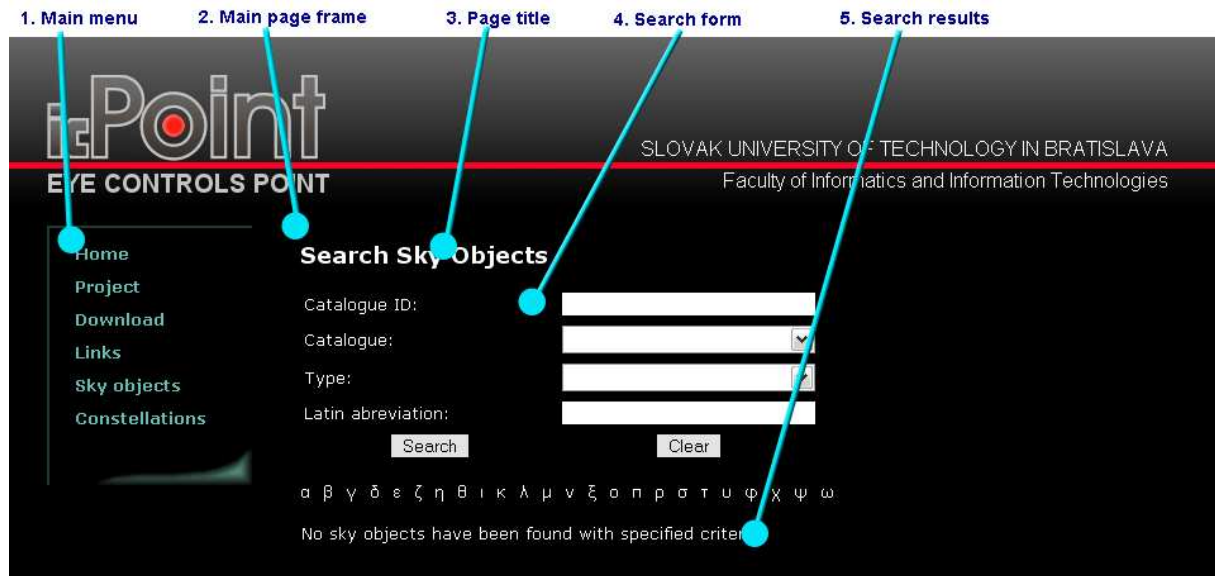
4.2. Application interface

Fig. 16. Elements of the basic application interface

The basic user interface is shown on Fig. 16. The left part of the page contains main menu. The dynamic web application is accessible by *Sky objects* and *Constellation* links. The main (center) part of the page usually contains a page title and can contain a form or list of results.

4.3. Sky objects searching

The interface for searching the sky objects is accessible by the *Sky objects* item in the main menu. It is shown in Fig. 17 and contains a search form and a list for displaying the search results. After entering the criteria to the fields and pressing the search button a search of the database is run and its results are displayed. The form contains a *Clear* button too for clearing all the form fields.
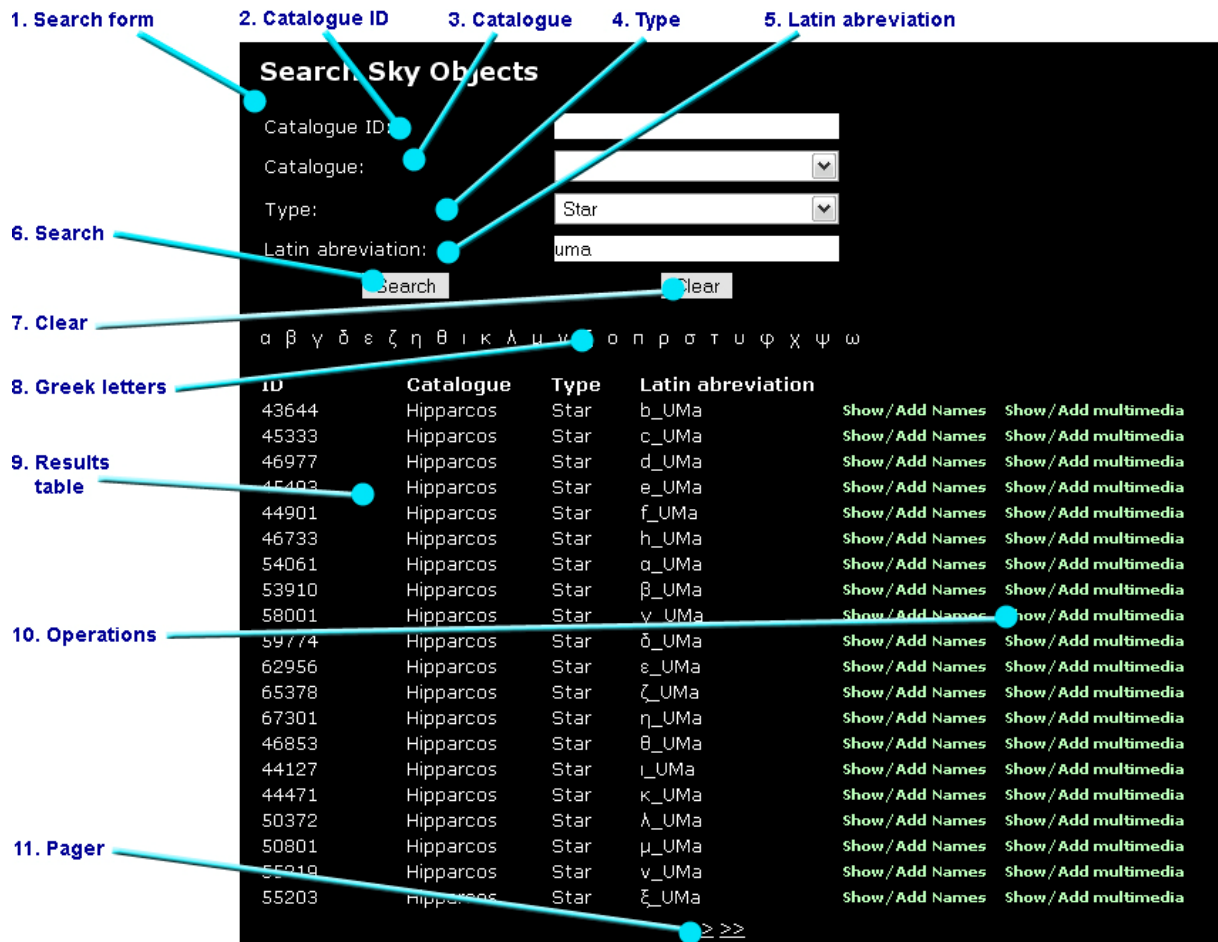
Fig. 17. Sky objects search interface

The form fields can contain these values:

Catalogue ID: the id of the sky object in the catalogue or a letter M/m for Earth's Moon

Catalogue: the name of the catalogue. Currently the application contains two catalogues – Hipparchos for stars and a planet catalogue with visible planets.

Type: the type of sky object, can be a star or a planet

Latin abbreviation: the latin abbreviation of the sky object, you can enter only a part of the abbreviation. You can use *Greek letters* to add Greek letters to this field.

The list of results shows a message in case there are no results to display, or the results themselves. If there are more than 20 results a pager is displayed, which can be used to switch to the other result pages. The list shows the id, catalogue name, type and Latin abbreviation for the sky object. It contains also the operations for sky objects: *Show/Add names* for displaying the Localized names interface (described in chapter 4.5); *Show/Add multimedia* for displaying the multimedia information for the sky object (described in chapter 4.6)

4.4. Searching the constellations

Using the interface for constellation search user can search the constellations, add new ones or display information about them. The interface is accessible by *Constellation* link in the main page menu and it is shown on Fig. 18. It contains a search form, buttons for searching, adding new constellations and clearing the form. After pressing the search button the search is made using entered criteria and results are show in the table bellow the form
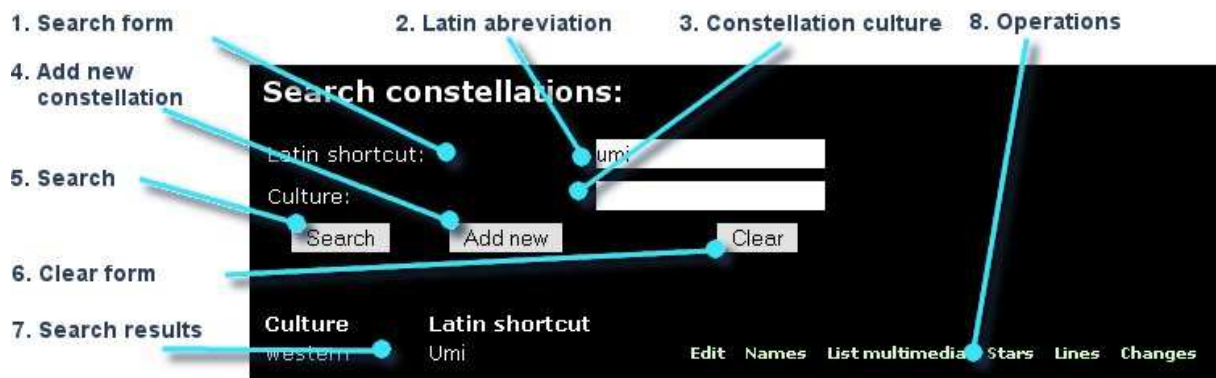

Fig. 18. Search constellaions user interface

The application is searching for criteria also in constellation history, if a result is found in item history, the actual item is displayed and using the link *Changes* the history can be viewed. Form contains these fields (for adding a constellation all have to be filled):

Latin abbreviation: the constellation latin abbreviation, up to three letters are allowed

Culture: constellation culture

The results table can display a message if no results are found, or the found results. It shows constellation culture, latin abbreviation and these operations for items:

Edit – editing the item, allows changing the constellation culture and abbreviation. After pressing this link a similar interface like Fig. 19 is shown. Two links are shown, *Update* for updating the item and *Cancel* for canceling the changes.

Fig. 19. Update item user interface

Names – link to Localized names interface for adding localized name to this constellation (described in chapter 4.5)

List multimedia – link to Multimedia information interface for displaying and adding multimedia information to the constellation (described in chapter 4.6)

Stars – link for displaying the list of stars in constellation. It is shown in Fig. 20. The interface contains the link for returning back to constellation, form for adding new star to constellation and a list of stars in constellation. The form contains field for Hipparchos catalogue ID of the star and a button for adding the star. The list of stars contains links *More info*, which displays more information about the star in sky object search interface and *Delete* for removing the star from constellation.

Lines – link for displaying the list of lines in constellation. These are used for graphical representation of the constellation in the main *icPoint* application. The interface is shown in Fig. 21. It contains the link for returning back to constellation, form for adding new line and the list of lines in constellation. For adding new line two Hipparcos catalogue star ID has to be entered to the form and the *Add* button has to be pressed. The lines list contains *More info* links for displaying the information about the star in Sky object search interface and *Delete* links for removing the line from the constellation.

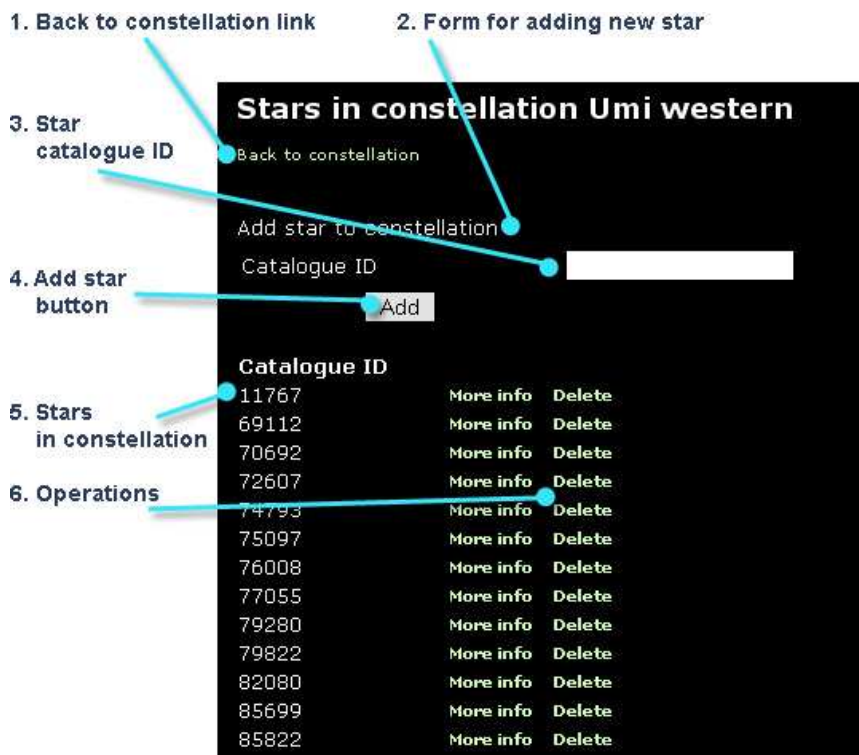Changes – link for displaying the history of changes for item. The interface is described in chapter 4.7.

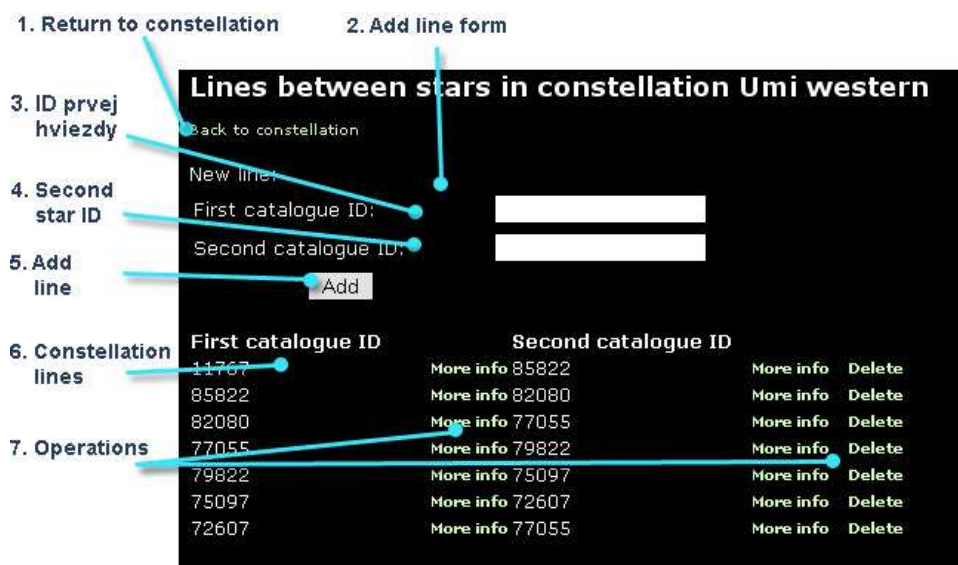

Fig. 20. Stars in constellation

Fig. 21. Lines in constellation

4.5. Working with localized names

Because of different localized names for different languages the application allows to change and add new names for sky objects and constellations. The interface can be displayed using *Names* links in results tables for searching sky objects and constellations. It is shown in Fig. 22 and contains the link for returning back to sky object or constellation, form for adding the name and list of localized names. New name can be added with the form, the name locale has to be specified too.

Fig. 22. Localized names interface

The list of localized names contains two operations: *Edit* operation for changing the name and *Changes* for displaying the list of changes (described in chapter **Chyba! Nenašiel sa žiaden zdroj odkazov.**). The locale cannot be changed; the name has to be corrected for the locale.

4.6.   Work with multimedia information

Multimedia information can be added to sky objects and constellations, downloaded to the main *icPoint* application and displayed. The interface for adding the multimedia information is accessible by the *Show multimedia* link in the results tables in sky object or constellation search interface. It is shown in Fig. 23 and contains the link for returning back to constellation or sky object, form for adding new multimedia information and list of multimedia information.

For adding new multimedia information all form fields has to be entered:

Title – information title, it will be displayed in the *icPoint* application

Language – information language

File – the file containing the multimedia information. Allowed are text files (txt, html), images (jpg, png, gif), audio files (mp3) and video files (avi). Maximum file size is 4 MB.

The list for displaying the multimedia information shows the title, language and information content type. Besides it contains operations *Download* for viewing (or editing) the information, *Edit* for changing the title, language or uploading new file for the information and *Changes* for showing the history of changes for the information (described in chapter 4.7).

Fig. 23. Interface for adding and displaying multimedia information

4.7.   Showing the history of changes

The application is capable of saving the history of changes for constellations, names and multimedia information. The history can be accessed by *Changes* link in the lists for displaying the items. The interface is similar to the one shown in Fig. 24. It contains link for

returning back to the constellation, localized name or the multimedia information and a table showing the changes. Table shows the date of change, the operation (Insert – new record inserted, Update – record update) and a *Description* of the change. In case of multimedia information history of changes a link for downloading the original file is displayed. The interface serves only for displaying the history, it is not possible to rollback the change, but it is possible to correct the record by updating it.

Fig. 24. History of changes for the multimedia information

4.8. Frequently asked questions

After adding new multimedia information the browser does not load the page.

You have tried to upload too large file to the page. It is allowed to upload files up to 4 MB size. If you try to upload larger file, server denies to access next page because of too large request.

When editing the multimedia information a file is needed.

If you want to edit multimedia information, you have to upload newer version of the file to the server. If you have not made any changes to the file, you can upload the original file, but the file is required.