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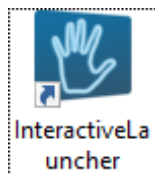
1. Configuring the software

1.1 Description of the software package

The system is a set of two programs:



TouchDetector – a tool for recognizing human interaction with a projection;



InteractiveLauncher – game menu for end user (check the end user guide in our website).

On the desktop of your computer, there are corresponding shortcuts to launch programs.

2.1 Configuring the Projection Interaction Tool



Launch **TouchDetector** by double-clicking the program shortcut on the desktop.

The program starts and runs in the background. The program icon is displayed in the system tray (Pic. 1).



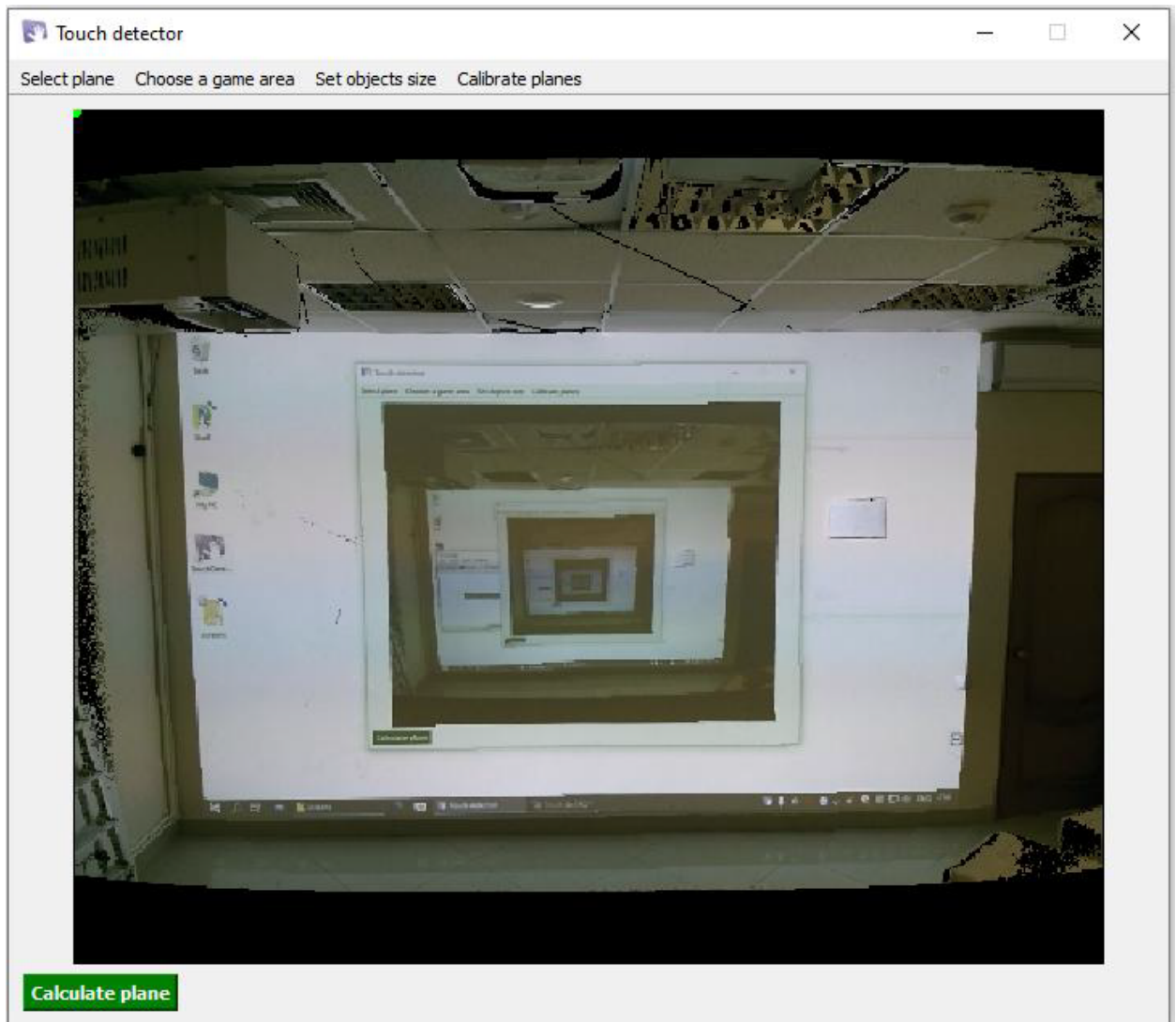
Pic. 1 Displaying the TouchDetector icon in the system tray

To display the main program window, left-click on the program icon in the tray, or use the context menu to select **Open** (Pic. 2).



Pic. 2 TouchDetector context menu

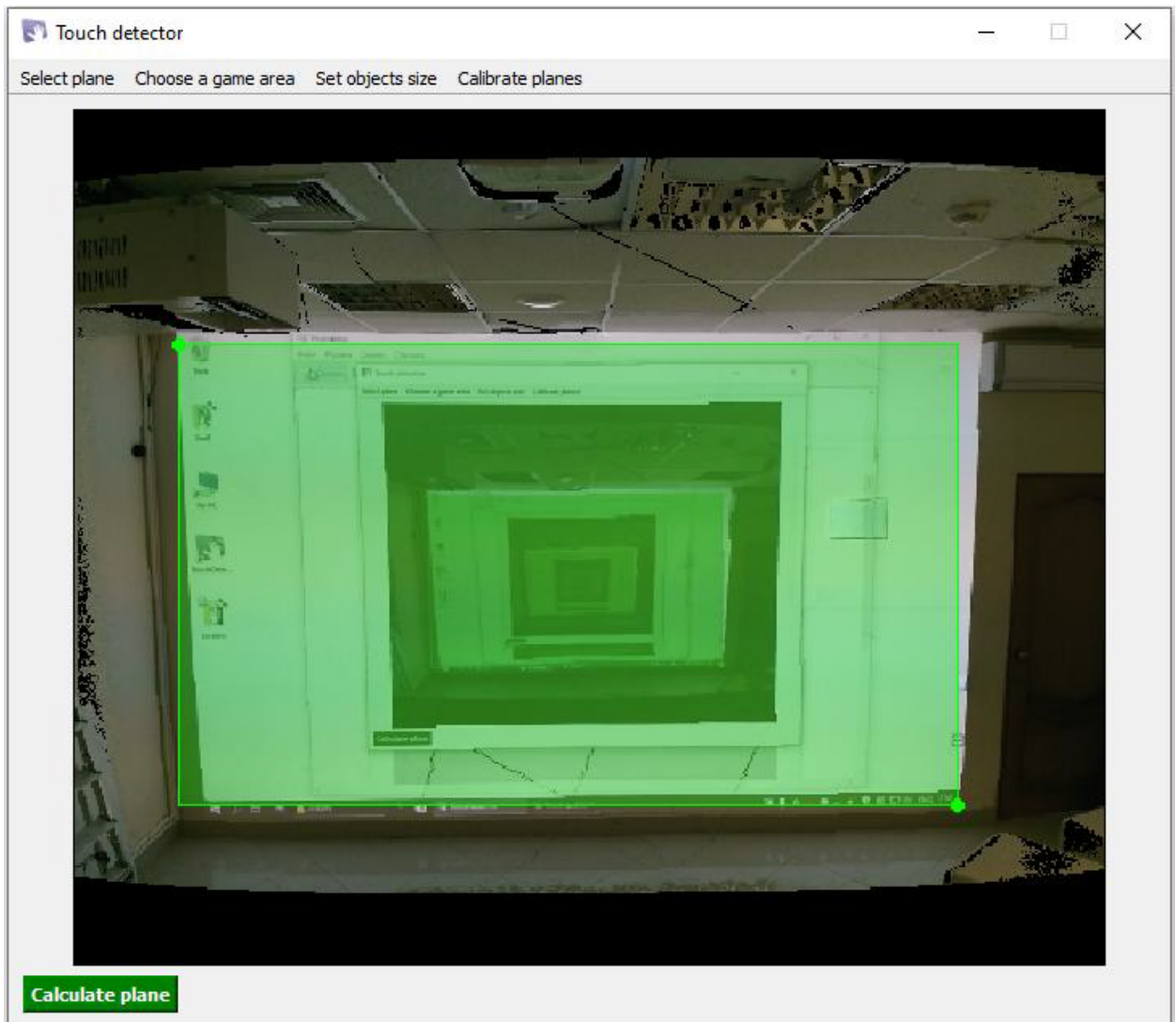
The main program window is shown in Pic. 3



Pic. 3 Main program window

1.2.1 Select plane

Open the "Select plane". You will see the image of the projection from the depth camera. Use the mouse to specify the upper left and lower right corners of the projection (Pic. 4).



Pic. 4 Select plane

Note! When installing the product "Interactive climbing wall" this step should be made before mounting the hooks on the wall if possible!

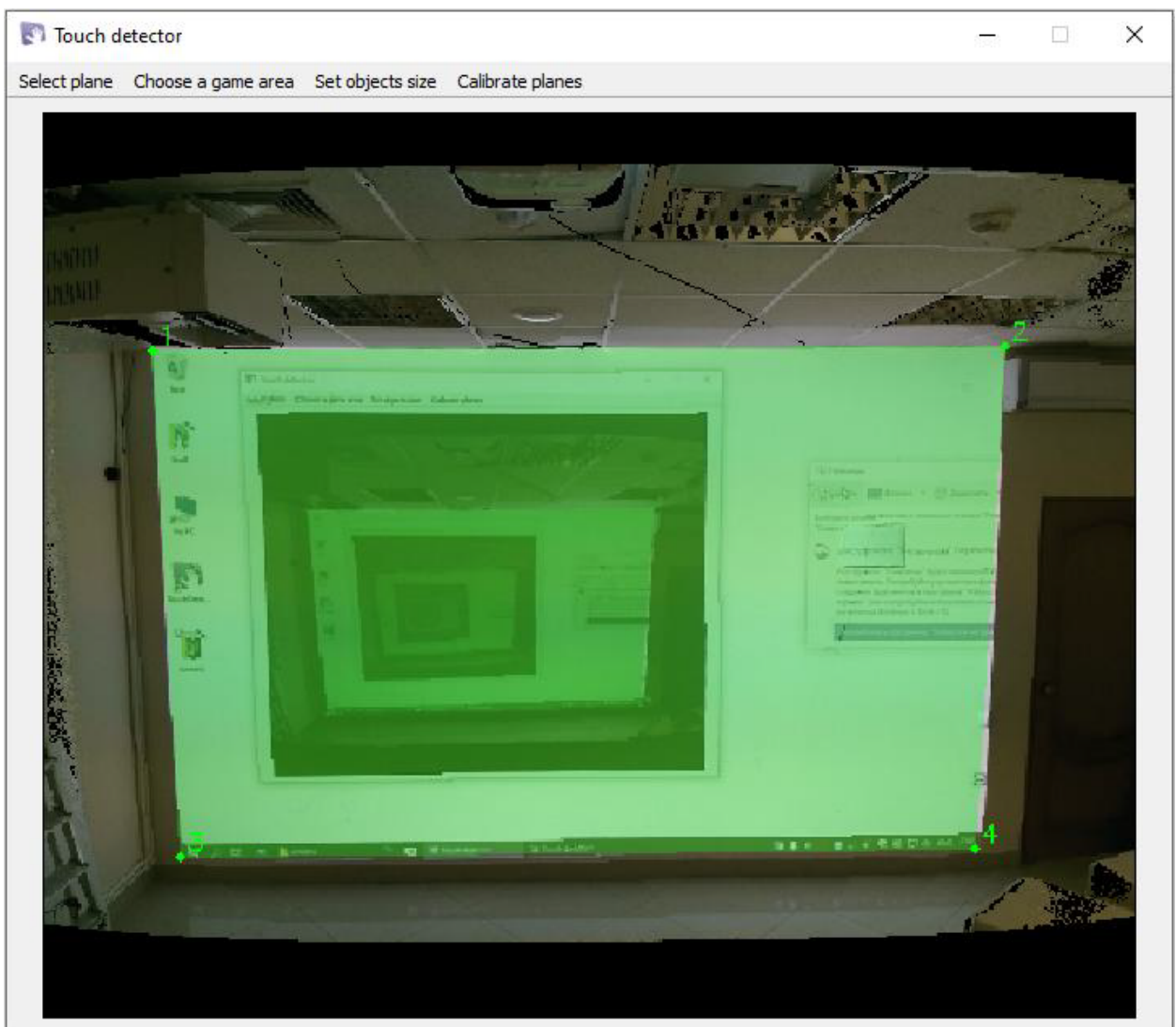
Next, press the **Calculate plane** button. The calculation will be made, the button will become inactive (fill color red) **Calculate plane**. It is necessary to wait until the button becomes active **Calculate plane**, which means the successful completion of the calculation.

1.2.2 Choose a game area

Open the "Choose a game area" tab (Pic. 5). Use the left mouse button to select the four projection angles in the following order:

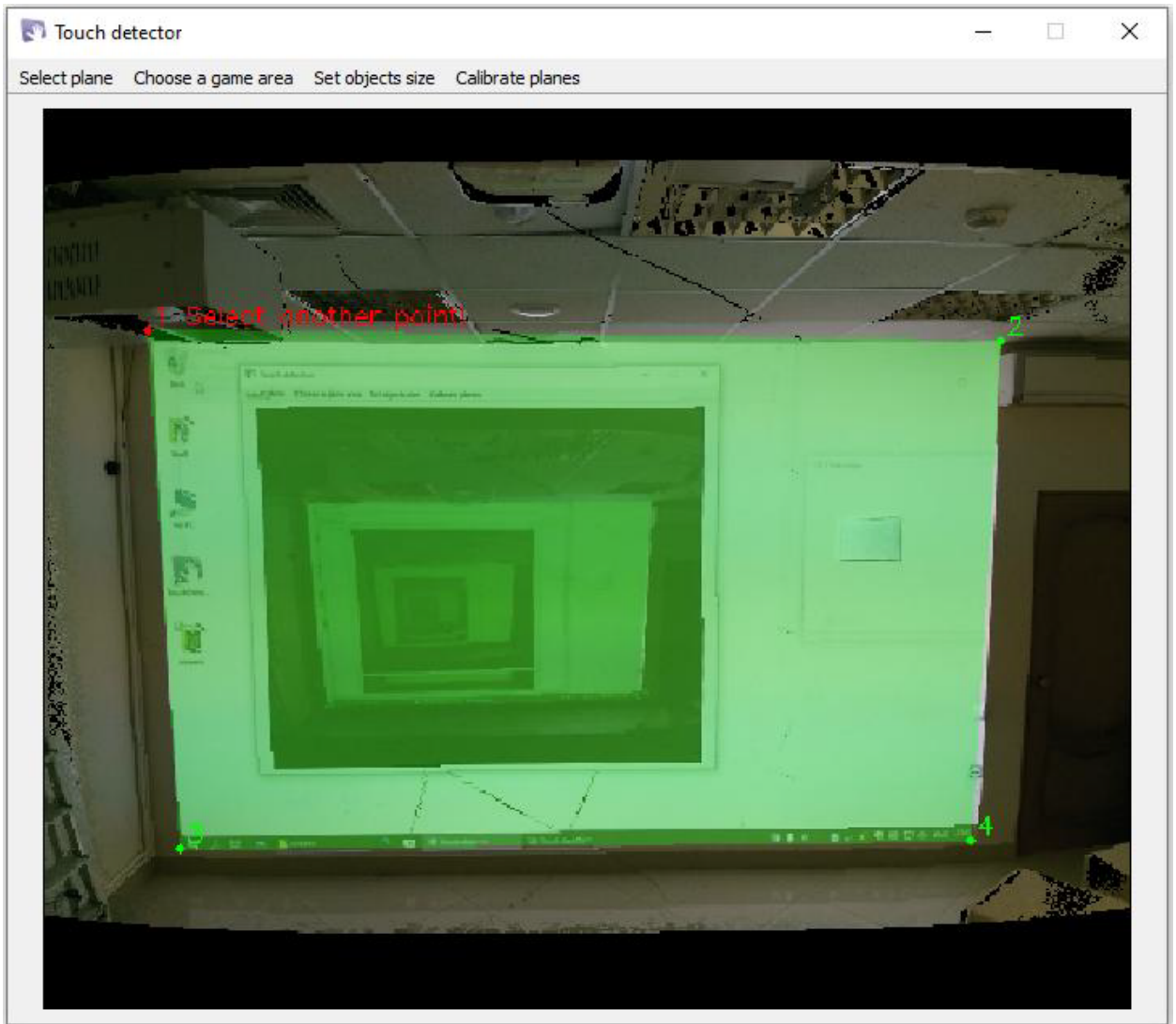
1. Top left corner;
2. Top right corner;
3. Lower left corner;
4. Lower right corner

If a "miss" occurs at any step of the sequence, the entire sequence must be re-run.



Pic. 5 Choosing a game area

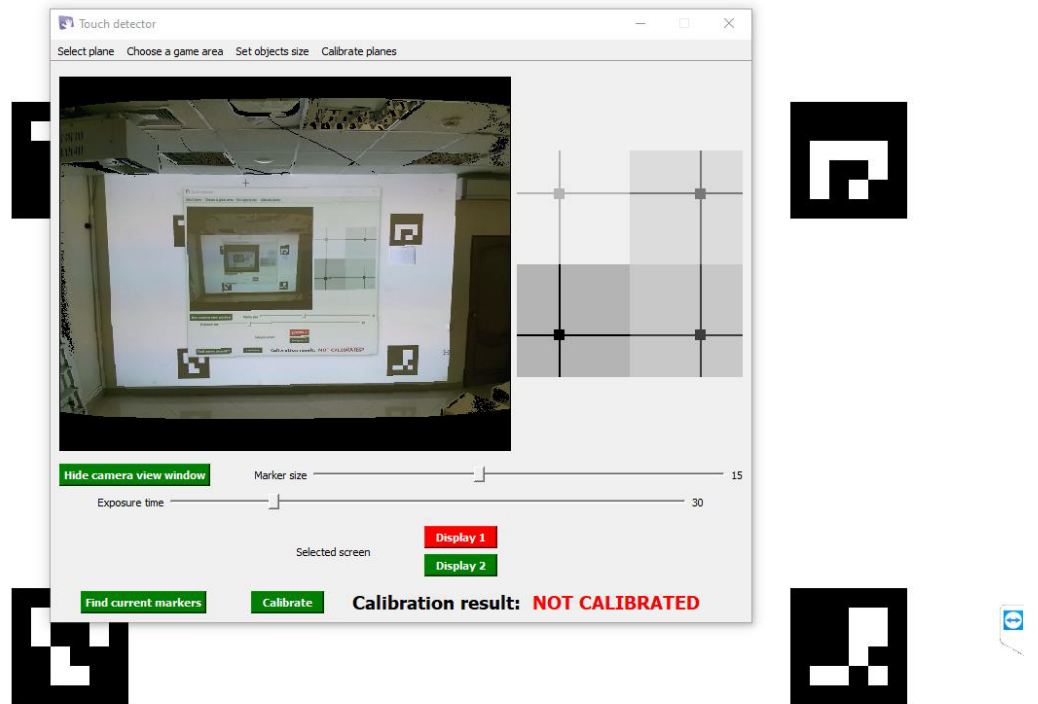
The **Select another point** error may occur when selecting a point (Pic. 6). This means that no depth value is defined at this point or the selected point does not belong to the plane calculated in step 1.2.1 *Select plane*. It is necessary to perform the entire sequence all over again and select a different point when repeating the sequence.



Pic. 6 Error when selecting an invalid point

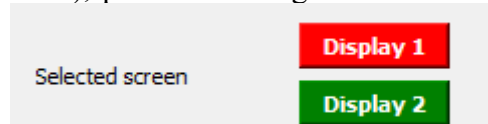
1.2.3 Calibration

Open the "Calibrate planes" tab (Pic. 7).

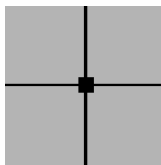


Pic. 7 Calibration screen

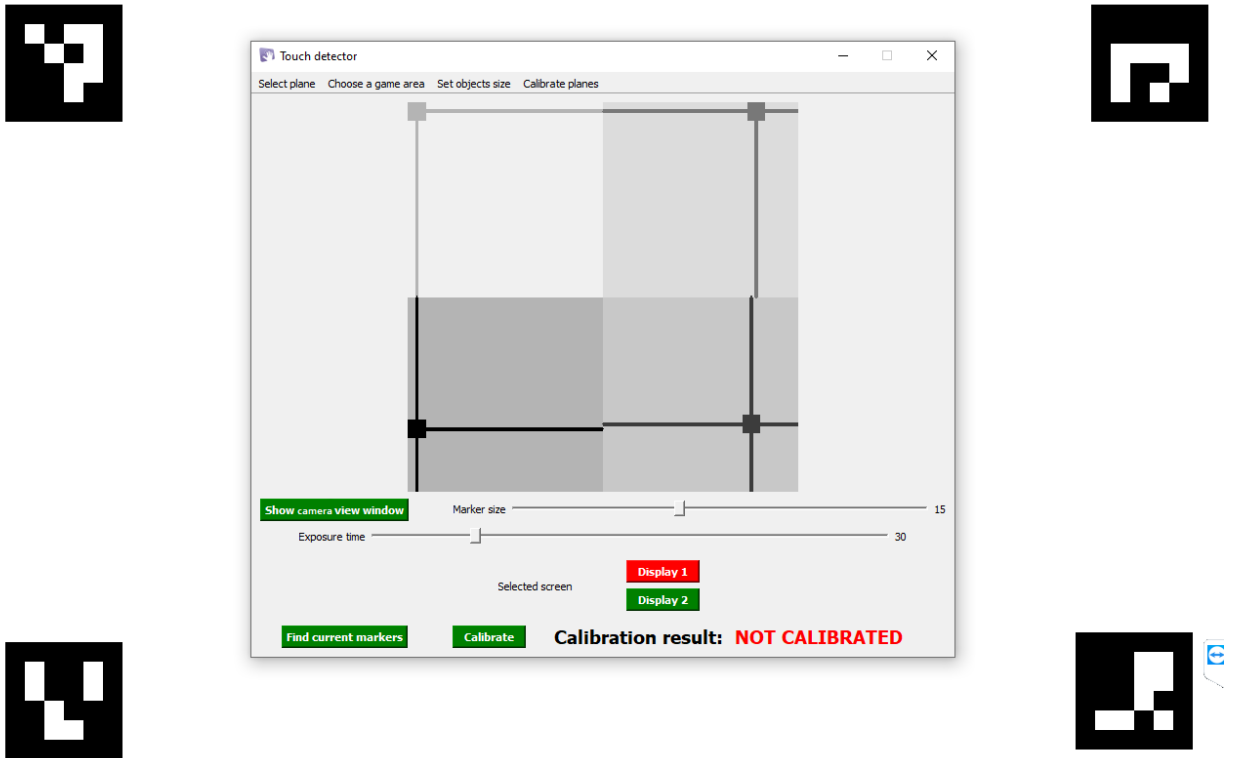
In addition to the main program window, you will see a subwindow with markers. The background must be placed on the projector screen (on the projection). If your system has additional output devices (monitors, projectors), place the background on the projection screen



using the output device selection buttons . The list shows the number of buttons equal to the number of connected output devices - in this case only the projector is connected, which is displayed as **Display 1**.

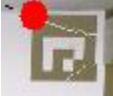


Using the mouse sliders, , position the markers symmetrically closer to the edges of the projection (the markers must not be covered by the main program window). Press the **Hide camera view window** button to remove the camera image that may interfere with the marker search (Pic. 8).



Pic. 8 Sample marker placement

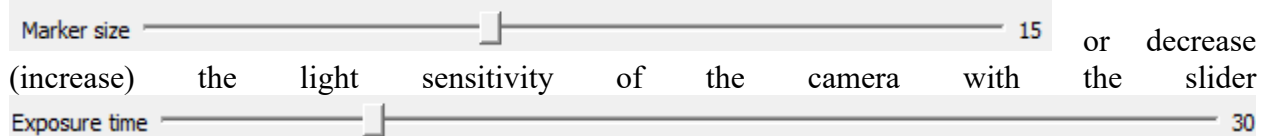
Press the **Find current markers** button. Next, return the camera view and check that all markers

are found successfully  (found marker will be marked red, Pic. 9).

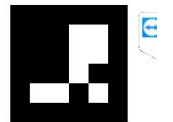
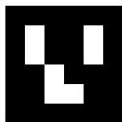
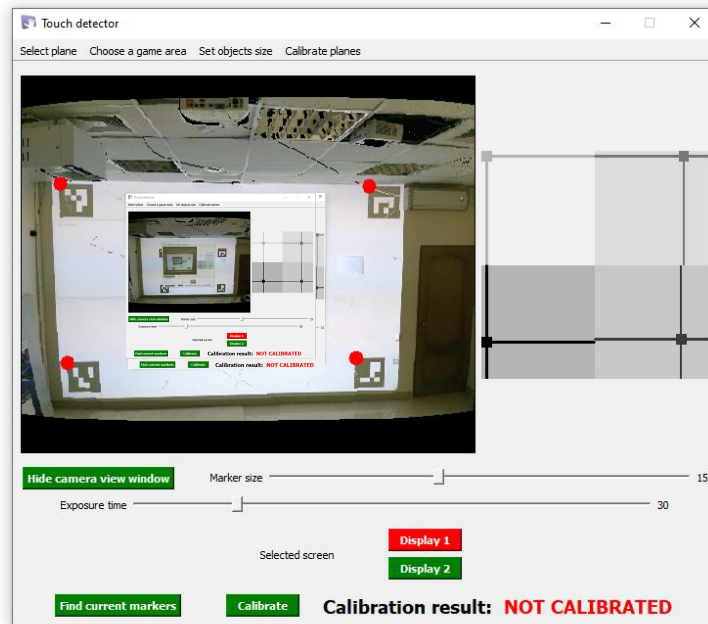
If markers are not detected, it is necessary to check the presence of environmental conditions that may interfere with marker detection:

1. The image from the projector is too bright and lights up the markers, or the projection surface is so reflective that it causes "glare" where the markers are located;
2. Marker image is too blurry. The depth camera is set too far (close) to the projected surface, or the projection images is out of focus

To level these conditions, you can try to increase (decrease) the markers with the slider




(increase) the light sensitivity of the camera with the slider. After the changes it is necessary to repeat the marker search algorithm, remembering to remove the image from the camera before pressing **Find current markers**.



Pic. 9 Successful search for markers

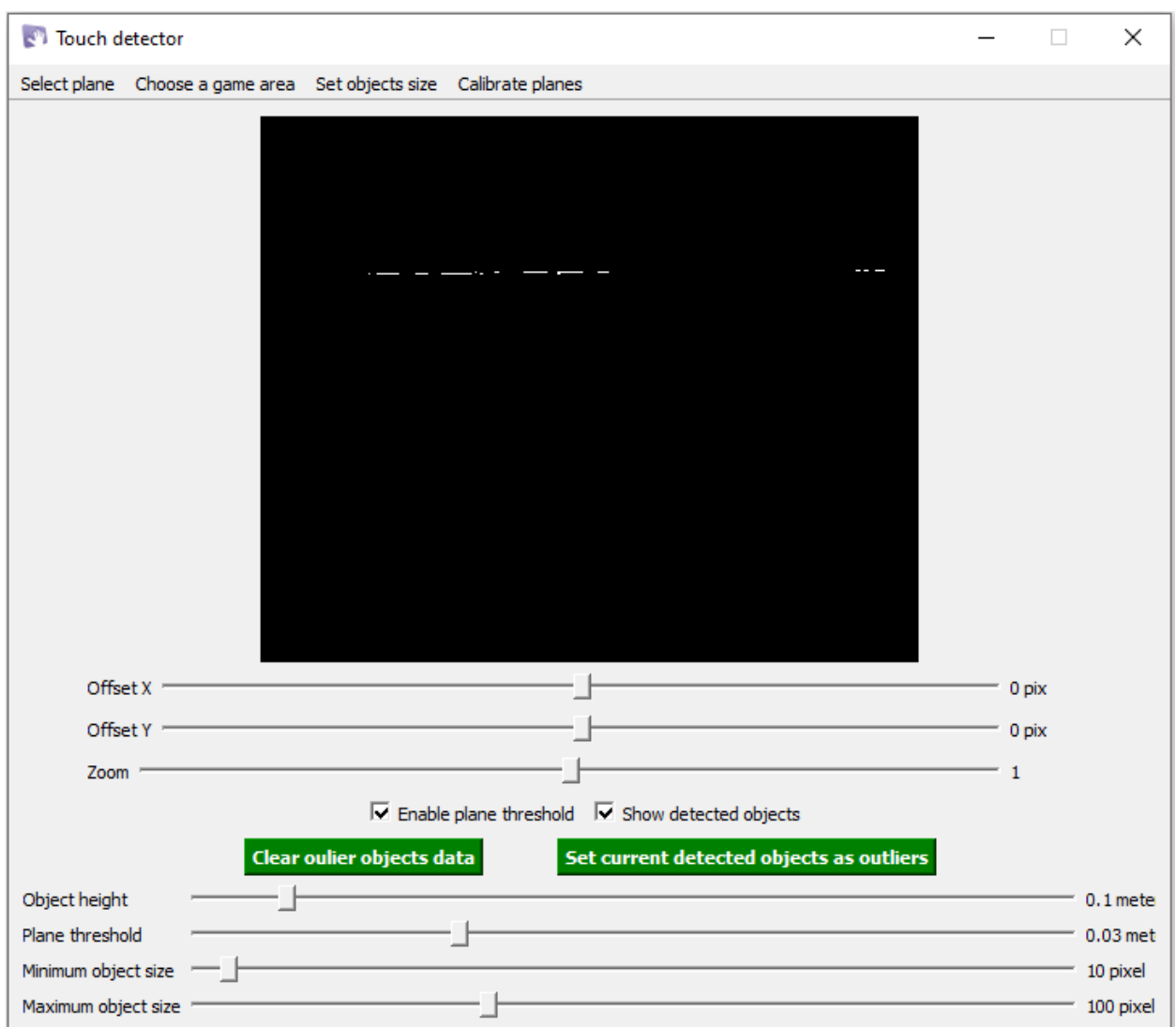
When all four markers are detected, press the **Calibrate** button. If successful, you will see **Calibration result: CALIBRATED**.

1.2.4 Setting the projection response

The program detects objects in the field of view of the depth camera and translates these objects into interaction with the projection. The objects can be hands, balls, etc. The object is displayed in a red rectangle on the depth picture . There will be a projection reaction at the place where the object appears.

Static objects on the projection (hooks, installed during the installation of the **product Interactive climbing wall**, power panels, sockets, etc.) can also act as objects of interaction with the projection.

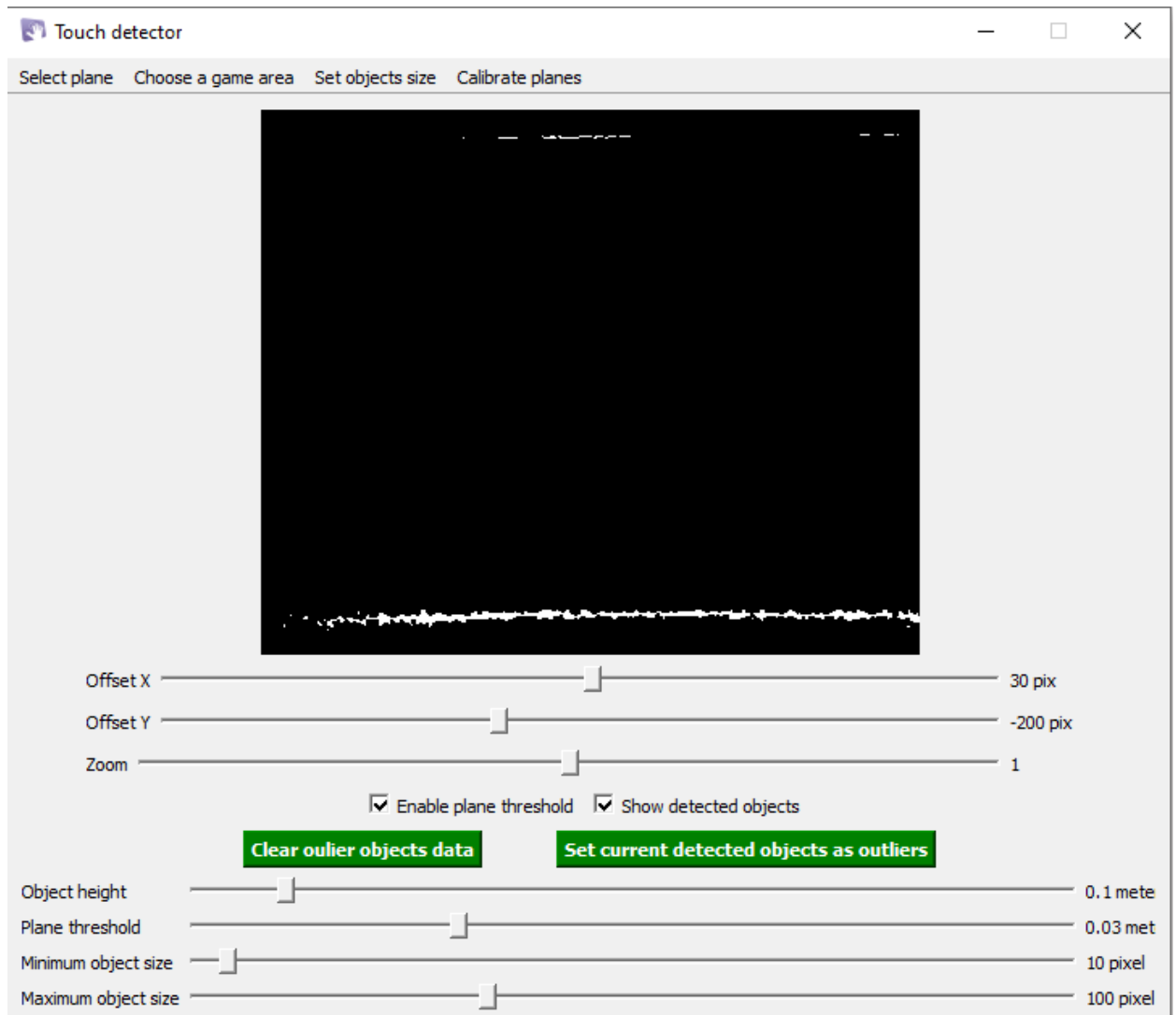
Open the “Set objects size” tab (Pic. 10). You will see the depth picture (point cloud) displayed from the depth camera.



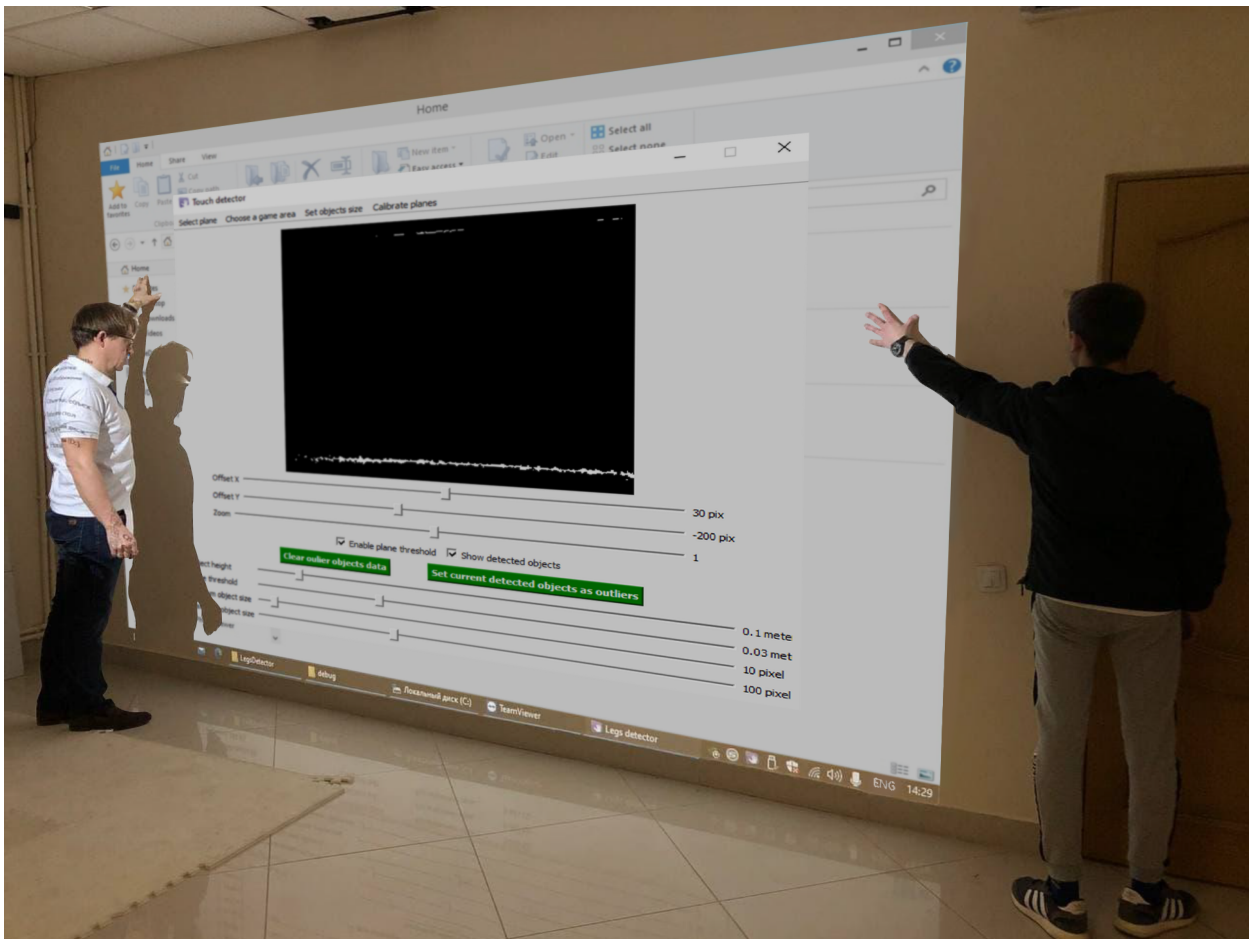
Pic. 10 Set objects size

First of all using the **Offset X**, **Offset Y** sliders it is necessary to align the center of the displayed window (depth picture) with the conditional center of the projection on the wall. Then using the **Zoom** slider it is necessary to align the depth picture with the projection size so that the displayed depth picture completely covers the projection (Pic. 11). This step can be helped by

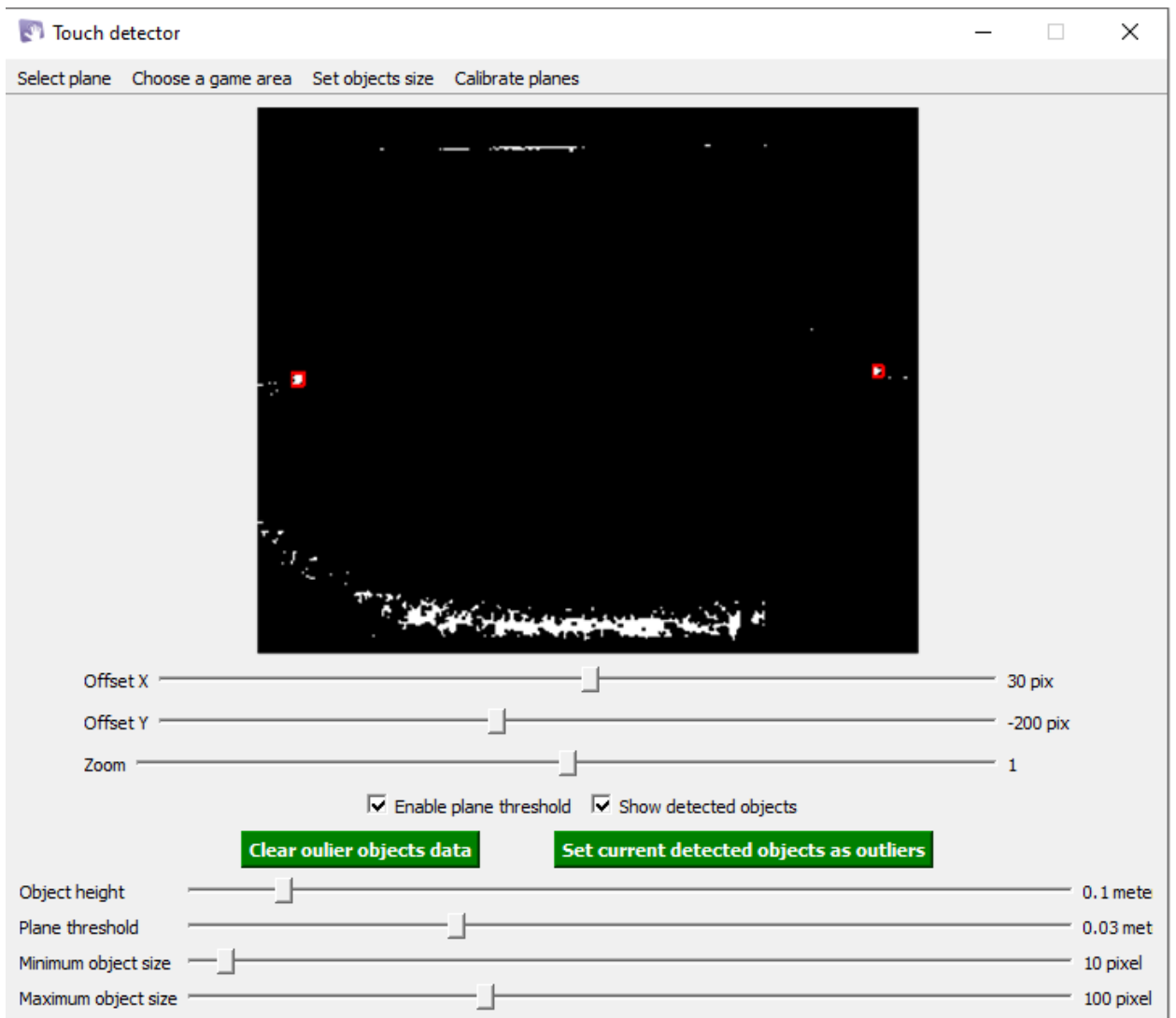
placing the hands on the edges (and corners) of the projection (Pic. 12) – by the result of matching in the depth picture, they may appear as objects, which means that the program works with the entire projection and does not cut it (Pic. 13).



Pic. 11 The result of aligning the depth picture and aligning it with the projection size (the white line at the top is the ceiling, the white noise at the bottom is the floor)



Pic. 12 Checking the alignment of the depth picture with the projection size

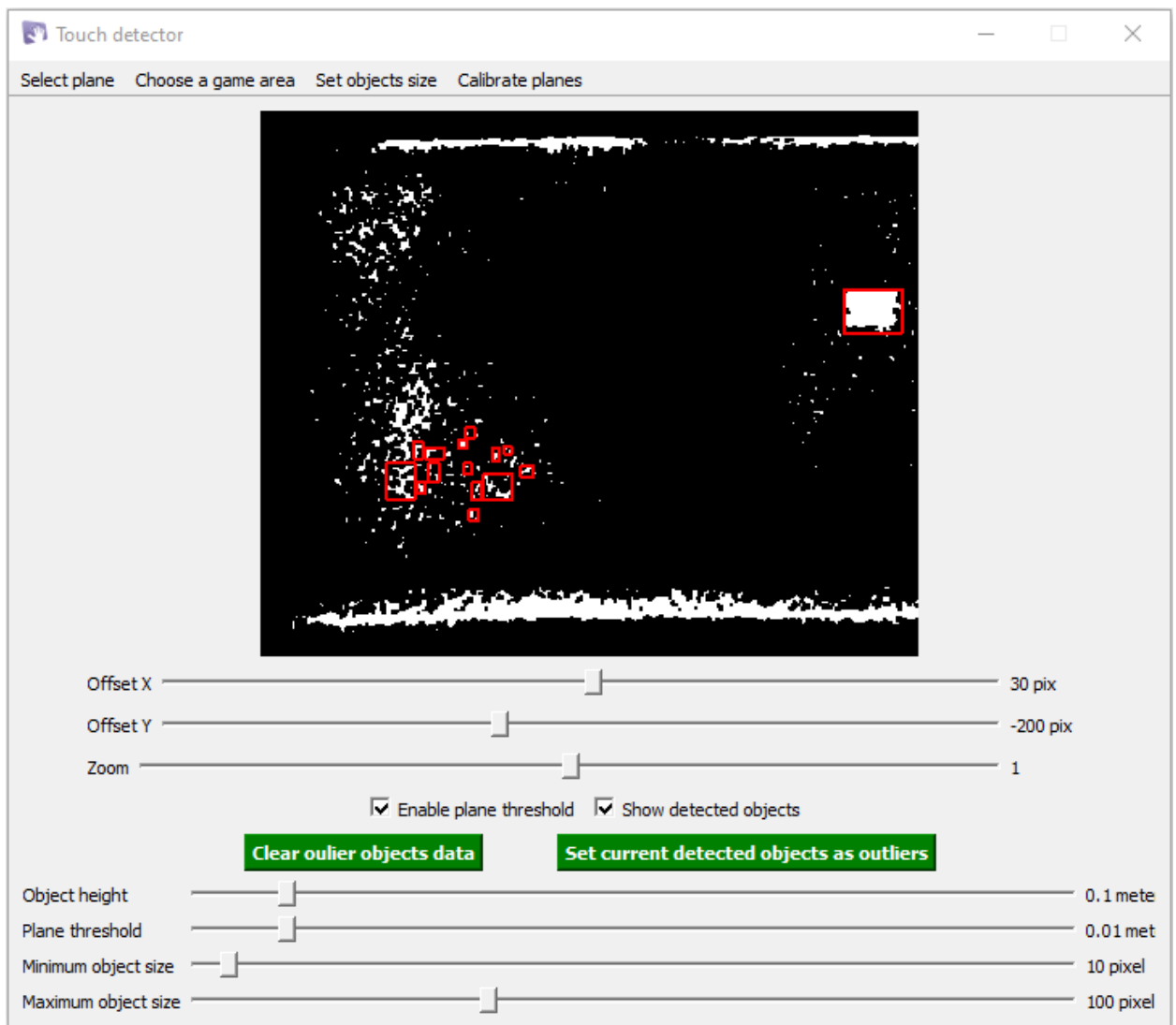


Pic. 13 Check result - the hands on the edges of the projection are visible in the depth picture

The task of the next setup step is to remove unwanted objects from the interaction (static, noise) and adjust the reaction to the necessary objects.

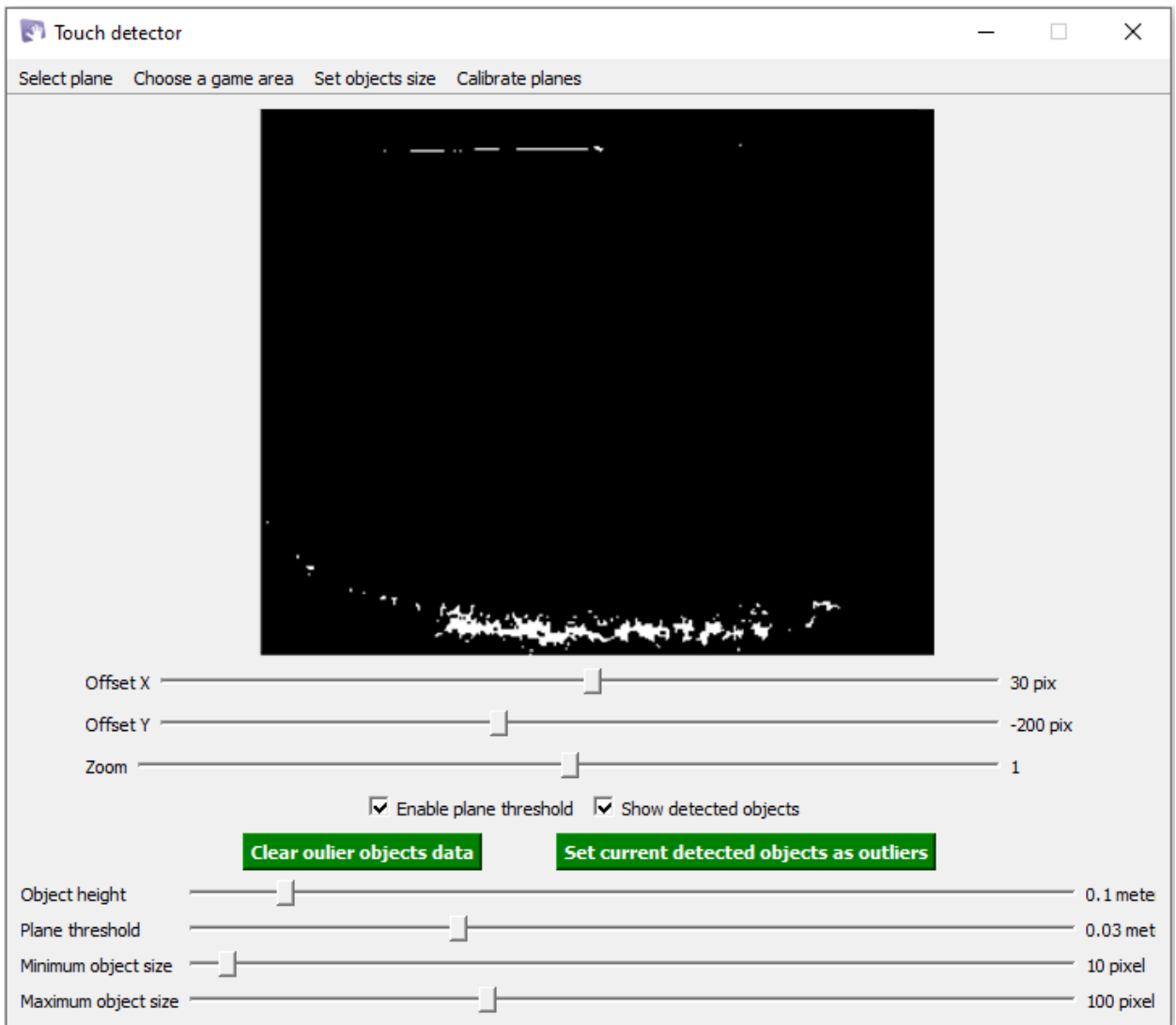
Below is a description of the settings and the algorithm for setting them:

1. Plane threshold options is measured in meters and represents a slice, within objects from the projection plane are not considered. For example, when you set the Plane threshold to 0.03 meters, objects within 3 cm of the projection plane are not considered when interacting with the projection. In general, the Plane threshold option helps to eliminate the noise that occurs when the program detects taps on a selected plane (Pic. 14);



Pic. 14 Noise when detecting objects

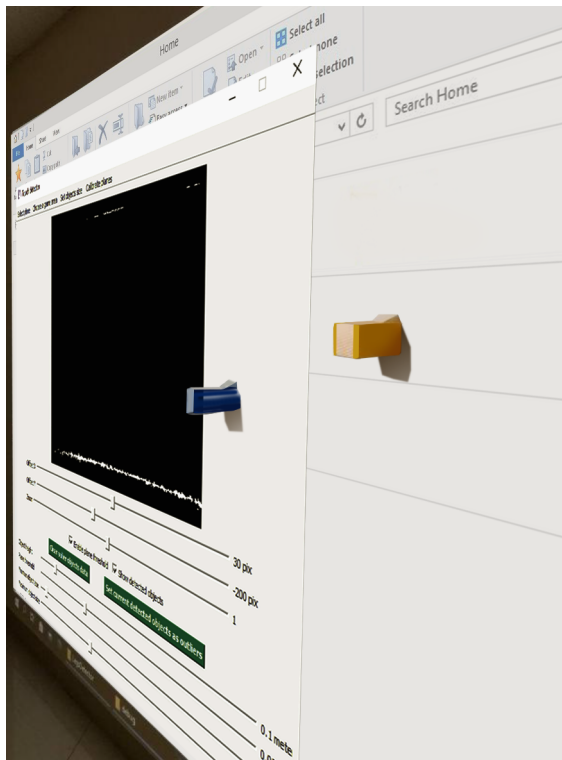
On Pic. 14 the Plane threshold setting is too low for this setting, which is a source of random "phantom" objects. Each of the "phantom" objects will participate in the interaction with the projection. It means that the projection will respond without action from the person. Noise should be eliminated by increasing the **Plane threshold** (Pic. 15).



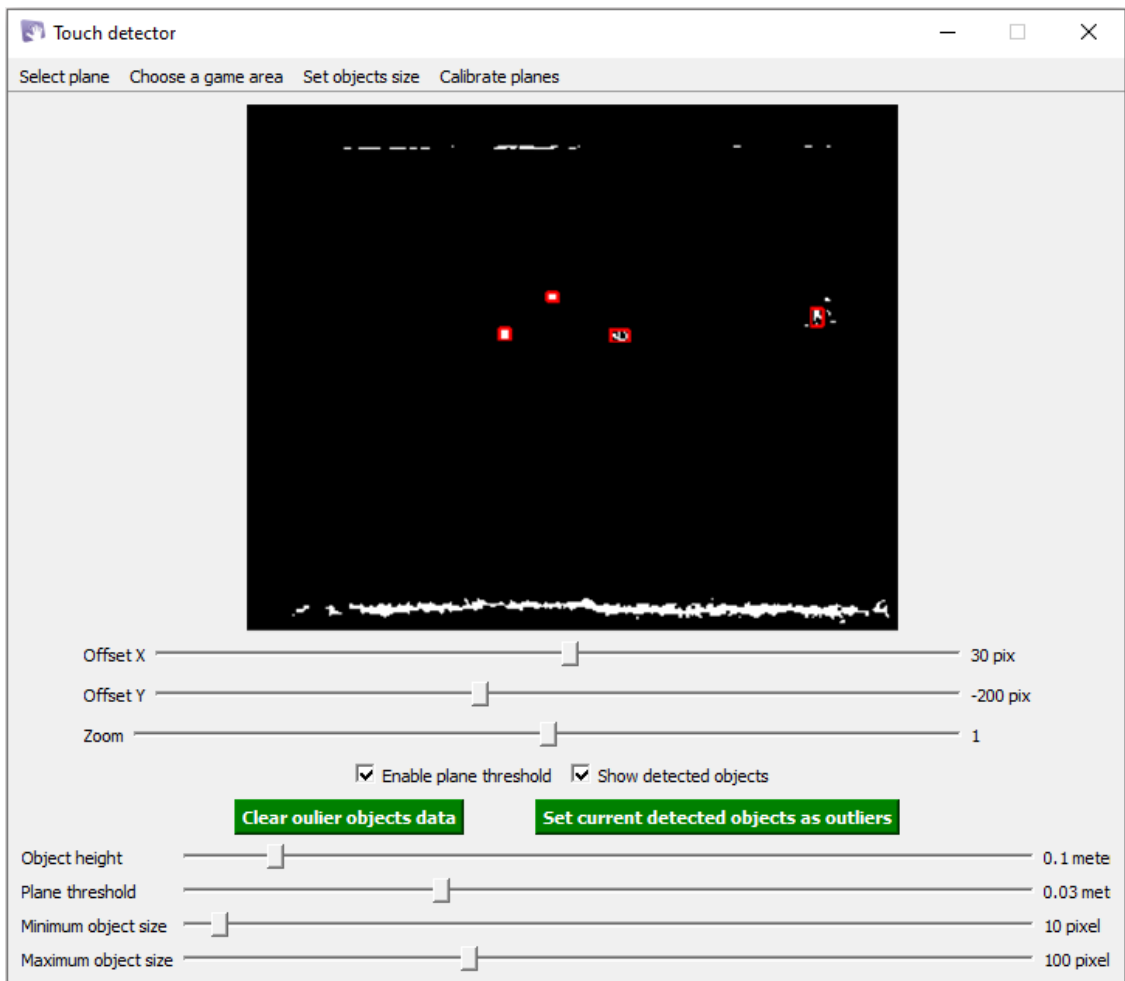
Pic. 15 Depth picture with excluded noise

The factory setting is usually sufficient to eliminate the noise, but may require adjustment.

2. **Set current detected objects as outliers** button helps to eliminate the effect on the projection of static objects that may be on the wall with the projection (e.g., power panels and so on). The found objects are subtracted from the depth picture when this button is pressed, and are no longer taken into account when the program works. This function can be useful when setting up the Interactive climbing wall, the installation of which involves the installation of hooks on the wall with a projection (Pic. 16), which can begin to be defined as objects (in case the Plane threshold is less than the height of the hook) (Pic. 17).

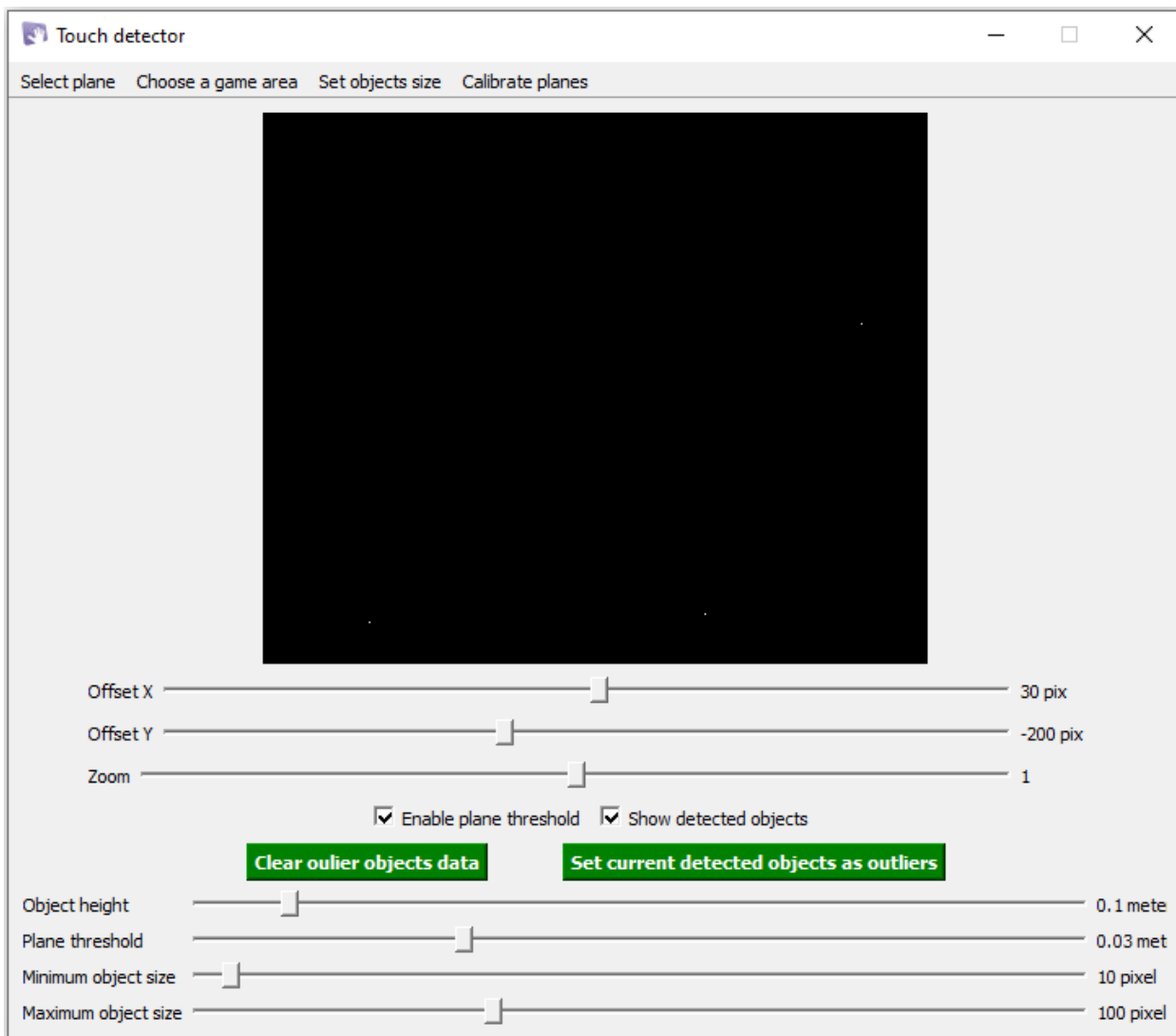


Pic. 16 Conventional installation of the rock climbing wall hooks



Pic. 17 Defining hooks as objects (red rectangles)

To delete the hooks (static objects) you need to press **Set current detected objects as outliers**. The mask will be calculated, the button will become inactive (red color of the fill) **Set current detected objects as outliers**. Wait for the button to become active **Set current detected objects as outliers**, which means the successful completion of the calculation. The result of removing the hooks (static objects) is shown in Pic. 18.



Pic. 18 Result of "Set current detected objects as outliers" operation

For successful elimination of hooks (static objects), they must be stably detected as objects (in red rectangles) while the program is running. If a hitch (static object) "blinks", this function may not work properly on this object. The following options are possible:

- 1) Decrease the **Plane threshold** to increase the proportion of the object in the sensor's working area (but be aware of the possibility of noise, see the description of the **Plane threshold**) or increase the **Object height** (see the description below). The definition of the object should become more stable, then you should try to exclude it with the **Set current detected objects as outliers**.

2) Increase the **Plane threshold** to hide the object in the nonworking area of the sensor (if the object has small dimensions). However, this may affect the quality of the program's detection of touches in the immediate vicinity of the projection.

It is necessary to experimentally find the best solution to eliminate objects, using the recommendations above.

In case it is necessary to correct the mask for elimination of snags (static objects), it is recommended to delete the current mask first using **Clear outlier objects data** and then continue searching for the optimal solution for elimination of objects, using the parameters described above and recalculating the mask again.

Note! Even if there are no hooks (static objects), you should perform the operation **Set current detected objects as outliers once when configuring the system.**

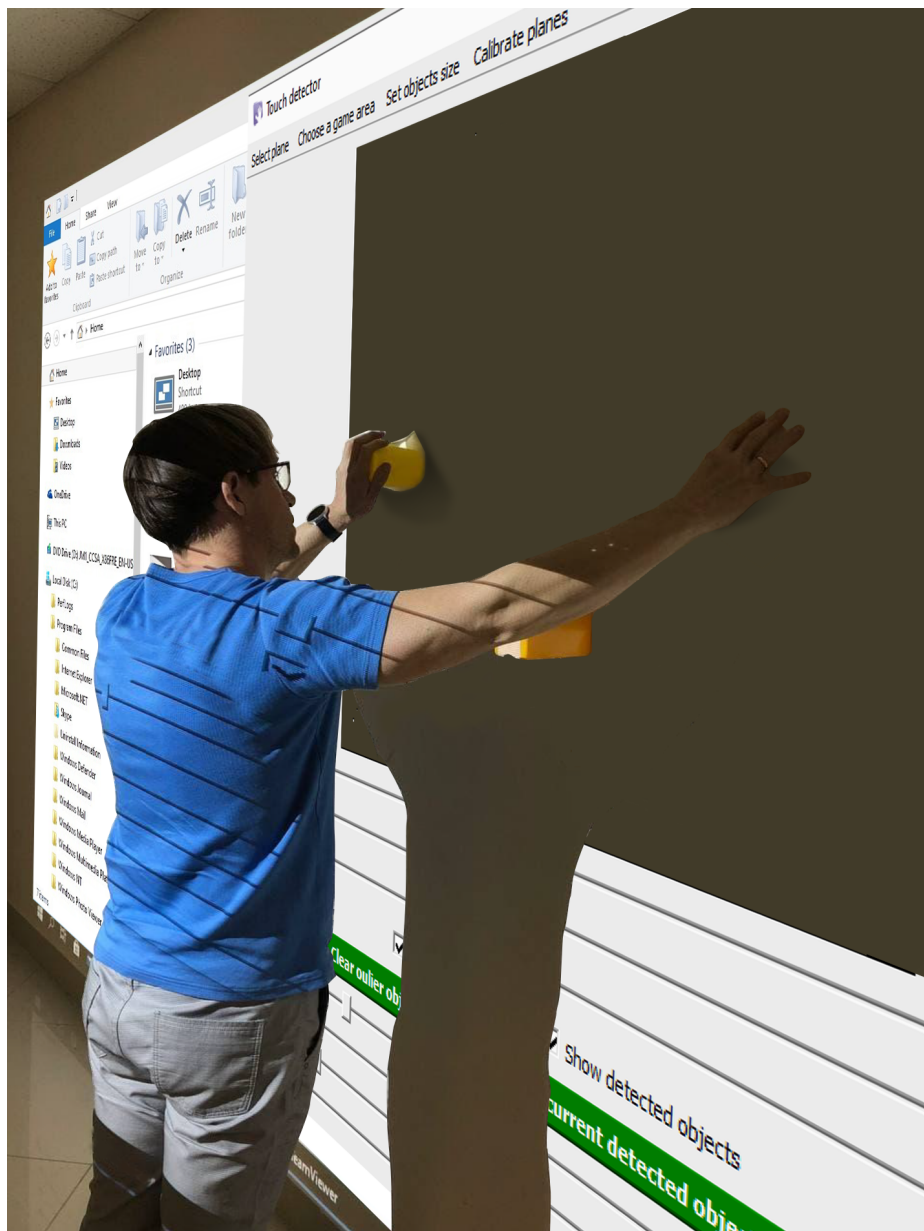
3. Object height defines the area from the projection plane within which objects are considered, minus the Plane threshold. Measured in meters. For example, if the 3. Object height is 0.1 m, it means that within the area from 3 cm from the projection plane (Plane threshold) to 10 cm objects will be taken into account. As a rule, the factory settings of this parameter are suitable.

Note! The Plane threshold value should not be more than half of the Object height. If you want to increase the Plane threshold, increase the Object height according to this rule.

4. If the depth camera is far away from the projection plane, objects near the projection plane may be very small, and the program will not be able to detect them. In this case you should try to decrease the Minimum object size.

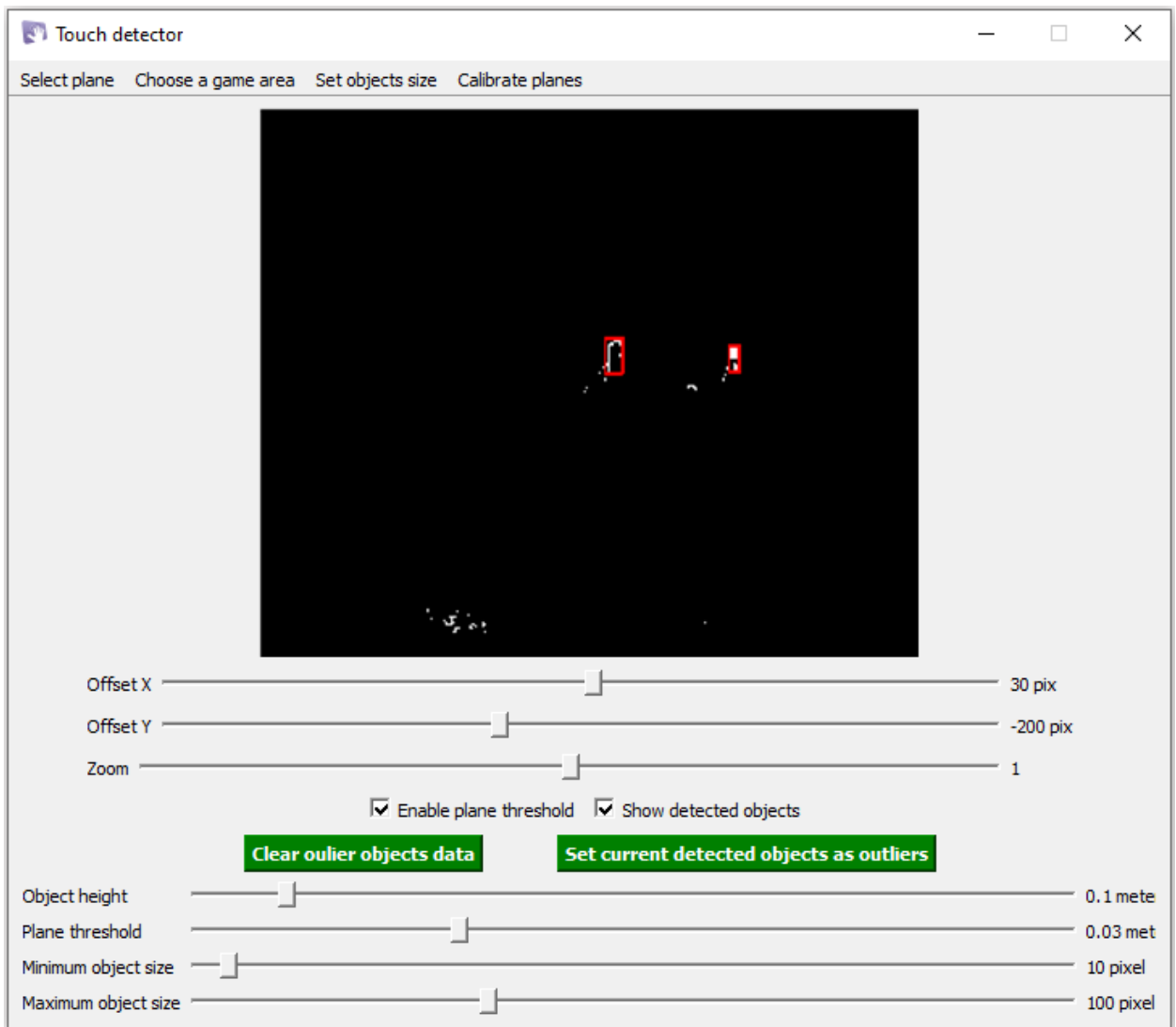
The rest of the parameters should be left at the factory default setting.

After you finish setting the parameters, you should check the definition of the hands (or balls) (Pic. 19).




Pic. 19 Sample hand definition check

The program must identify the hands (or thrown balls) as objects, and not identify unnecessary objects (Pic. 20).




Pic. 20 Correct determination of the hand program when interacting with the projection


1.2.5 Completing the TouchDetector setup

After going through the configuration steps described above, you should **terminate the program** by clicking on the cross in the upper right corner of the main program window  or using the context menu of the program in the system tray (Pic. 21). Then the program will start and stop automatically when you work with the game menu.



Pic. 21 Ending a program via the system tray menu

If there is a program icon  in the system tray, the program continues to run.

Note! When you have finished configuring, be sure to close the program by clicking on the cross  in the upper right corner of the main program window, or through the menu in the system tray (Pic. 21).