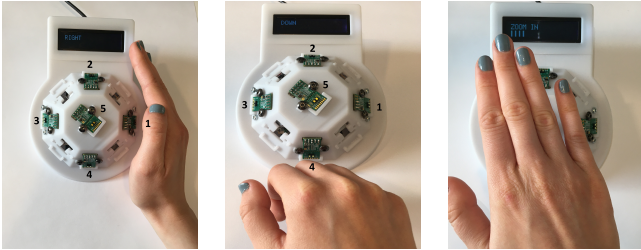


# Hand gesture control of surveillance cameras

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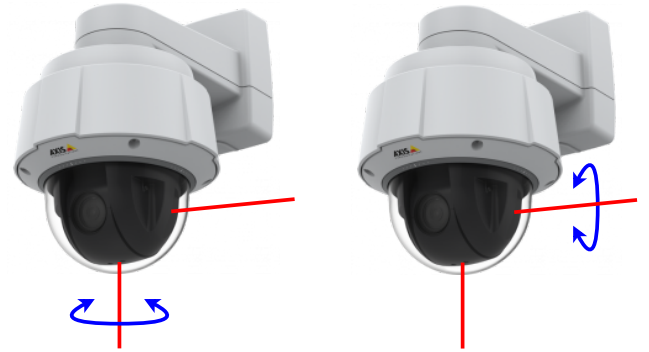


Nowadays, many industries are investing a lot of resources in new technologies to interpret hand gestures. However, this is not the case of the surveillance industries. Instead, the joystick and the mouse are the most common devices found in control rooms. Both work well but some operators report persistent pain after a demanding work day. Based on this, the purpose of this master thesis is to investigate the possibility of using hand gestures to control surveillance cameras. To verify the validity of the idea a prototype is developed to control Pan-Tilt-Zoom (PTZ) cameras, with special emphasis on having an intuitive and ergonomic design.

Have you ever seen a movie where the characters are controlling big monitors by pointing with their hands in the air? It looks really cool and futuristic and you might think of when these products will be for real. The answer is: they already are. Simple solutions as automatic soap dispensers and water taps have been on the market for a long time, but also, several other industries are investigating and trying to integrate the gesture controlled technology into their products.

As of today the most common way of controlling surveillance cameras is by using a joystick, but solutions with the computer mouse do also occur. The idea of instead controlling the cameras by touch-free hand gestures came to life as a result of that many other industries are exploring the field of human-machine interaction through hand gestures. In addition it was thought that this way of controlling would be a lot more intuitive as well as ergonomic to the users. As a clarification for those who are not familiar with surveillance cameras, the so-called Pan-Tilt-Zoom (PTZ) cameras are capable of moving their lens around different axes in order to cover a wider field of view. Pan means that the camera can move within its horizontal plane (Figure 2a). Tilt implies that it can also move in its vertical plane (Figure 2b). Finally, Zoom refers to that it can observe the objects closer or further.

In order to gather results it was decided to test the prototype with real users. During these tests it was possible



(a) Pan, rotation around the vertical axis.

(b) Tilt, rotation around the horizontal axis.

Figure 2: Pan (a) and tilt (b) movements of a PTZ camera.

to observe the participant's behaviour and experience when using the device by the first time. The data obtained was used to draw the conclusions of this thesis. It was possible to verify that the implemented gestures were intuitive for the users. They were able to learn how to use the device in a fairly short time. Most of the errors detected while the users were performing the tasks could be easily prevented if they gain more experience using the device. Besides that, from the observations and the participants' suggestions, it was possible to define the fundamental aspects that needed to be improved. The prototype was modified by adding more functionalities and a more ergonomic case. The final prototype is presented in Figure 3.



Figure 3: Final prototype.

**To get the device to track the position of the hand,** some type of sensors were needed. It was decided to use five infrared sensors which sends out an infrared light that bounces at the hand and then goes back to the sensor. From this, the time it takes for the light to go back to the sensor is calculated, and by this it is possible to know the exact position of the hand at all times. The device then uses this information to figure out how the user wants the camera to move, and sends the corresponding action to the camera which executes it.

**In the future** the main purpose of the device is of course to control PTZ surveillance cameras in control rooms, however it has potential to be used in other scenarios as well. The device could be installed in different show rooms to let potential customers know what can be done, but also to let them try the cameras in a fun way. Furthermore, when having the sanitary aspect in mind, it would be great to use for the staff in hospitals and nursing homes.

If the device is applied outside the surveillance industry, it would come to great use in cars to control the audio system, blinkers or other features.