

Body Tracking



Hand Tracking



Sorting



Intelligent Robotic System for Sorting LEGO Parts

Robotix-Academy Roadshow 2022

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Agenda

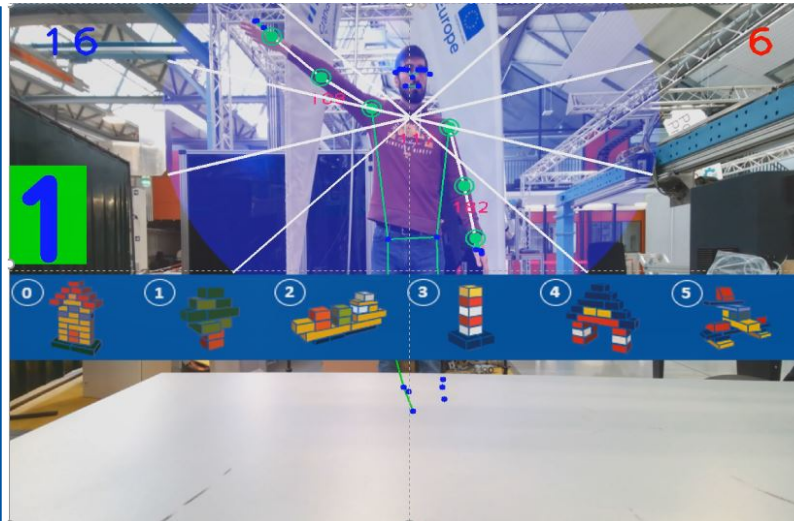
- 1 Overview Body/Hand Tracking
- 2 Body Tracking
- 3 Hand Tracking
- 4 Implementation

Agenda

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- 2 Body Tracking**
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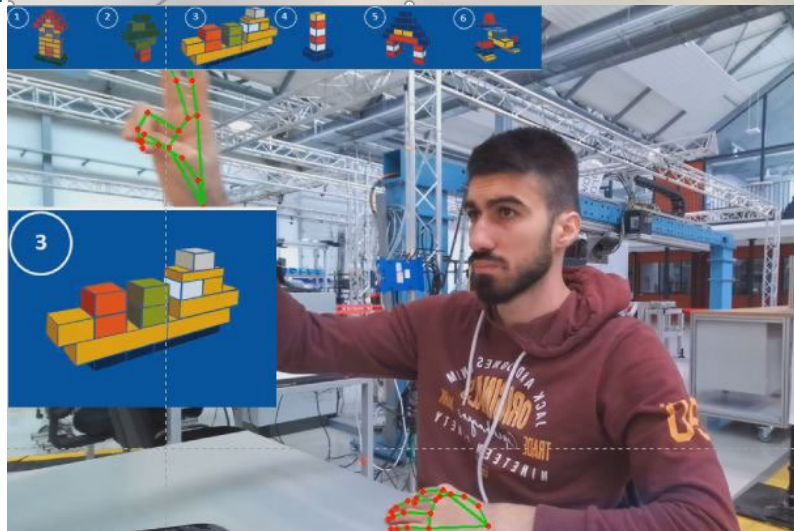
Body/Hand Tracking with choosing LEGO Assembly Plan

Body Tracking: choosing an assembly group



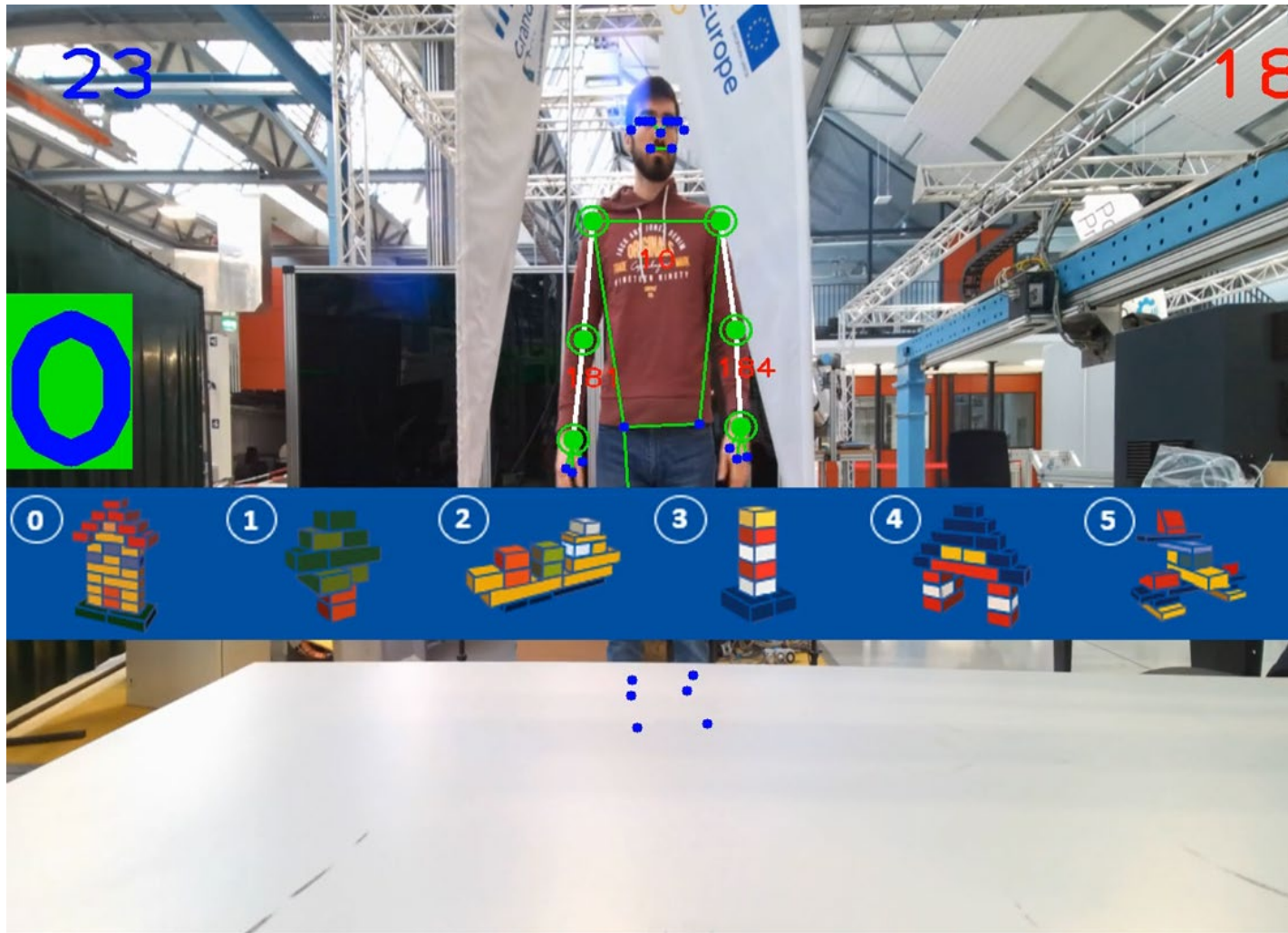
- Goal: Using the Body Tracking to choose an assembly group from multiple assembly modes.
- Far away from the camera, body tracking mode will be activated. The Body Tracking program last only 20 seconds. The last selection of the human will be saved.

Hand Tracking: choosing an assembly part



- Goal: Using the Hand Tracking to choose a product from an assembly group.
- After the 20 seconds from the body tracking end. The human come close to the camera and select a product with hand tracking.

Body/Hand Tracking with choosing LEGO Assembly Plan



- 20 Seconds will be given to human to choose an assembly group.
- At the end of body tracking the mode which the human chose will be saved
- After 20 seconds the human gets close to the camera and activates the hand tracking mode.
- Use the hand tracking to choose a product from the assembly group.

Agenda

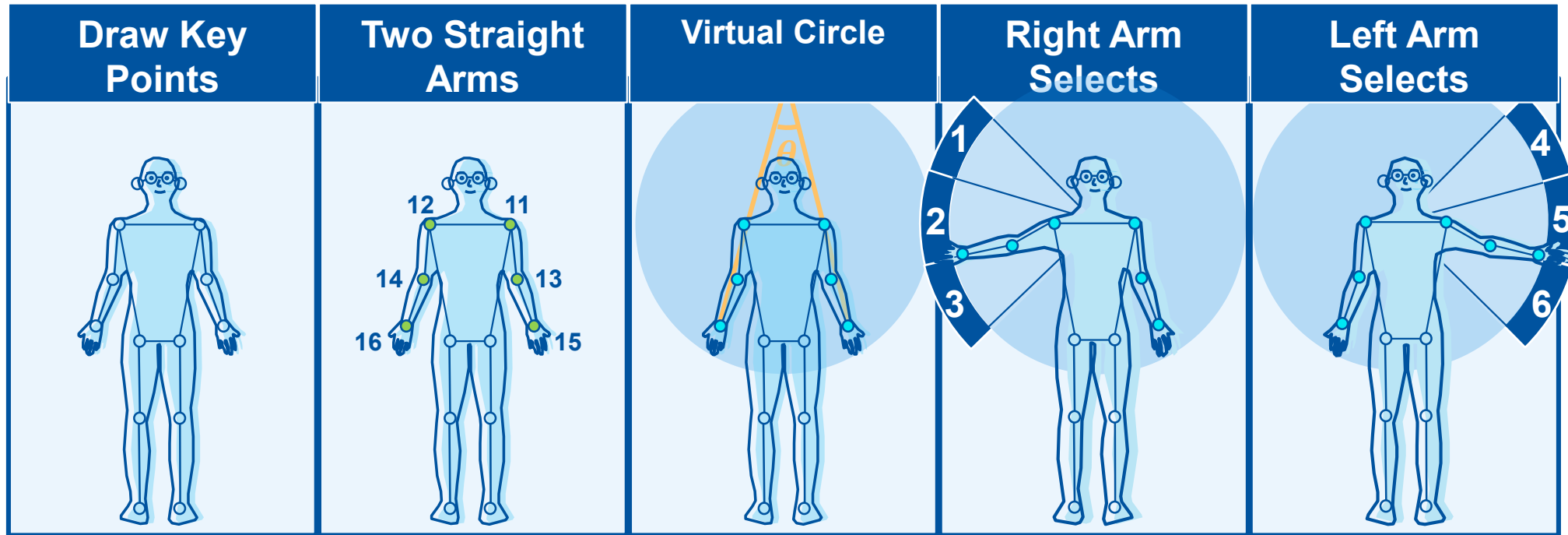
1 Overview Body/Hand Tracking

2 **Body Tracking**

3 Hand Tracking

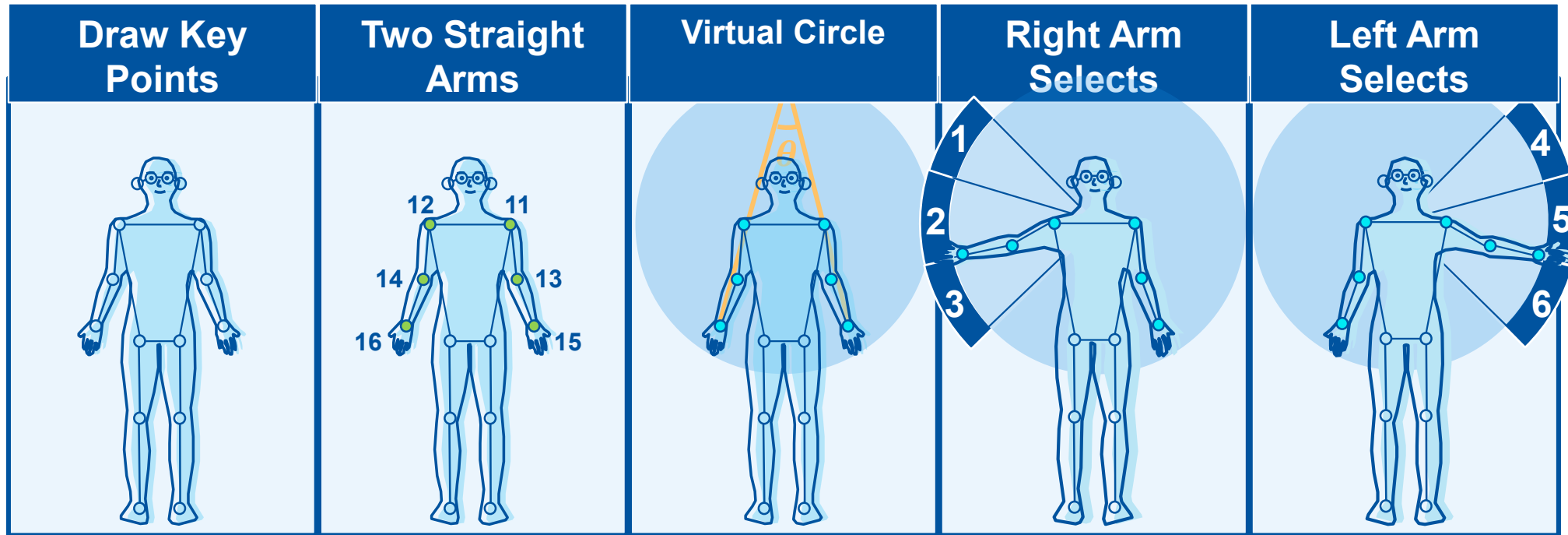
4 Implementation

Body Tracking Concept



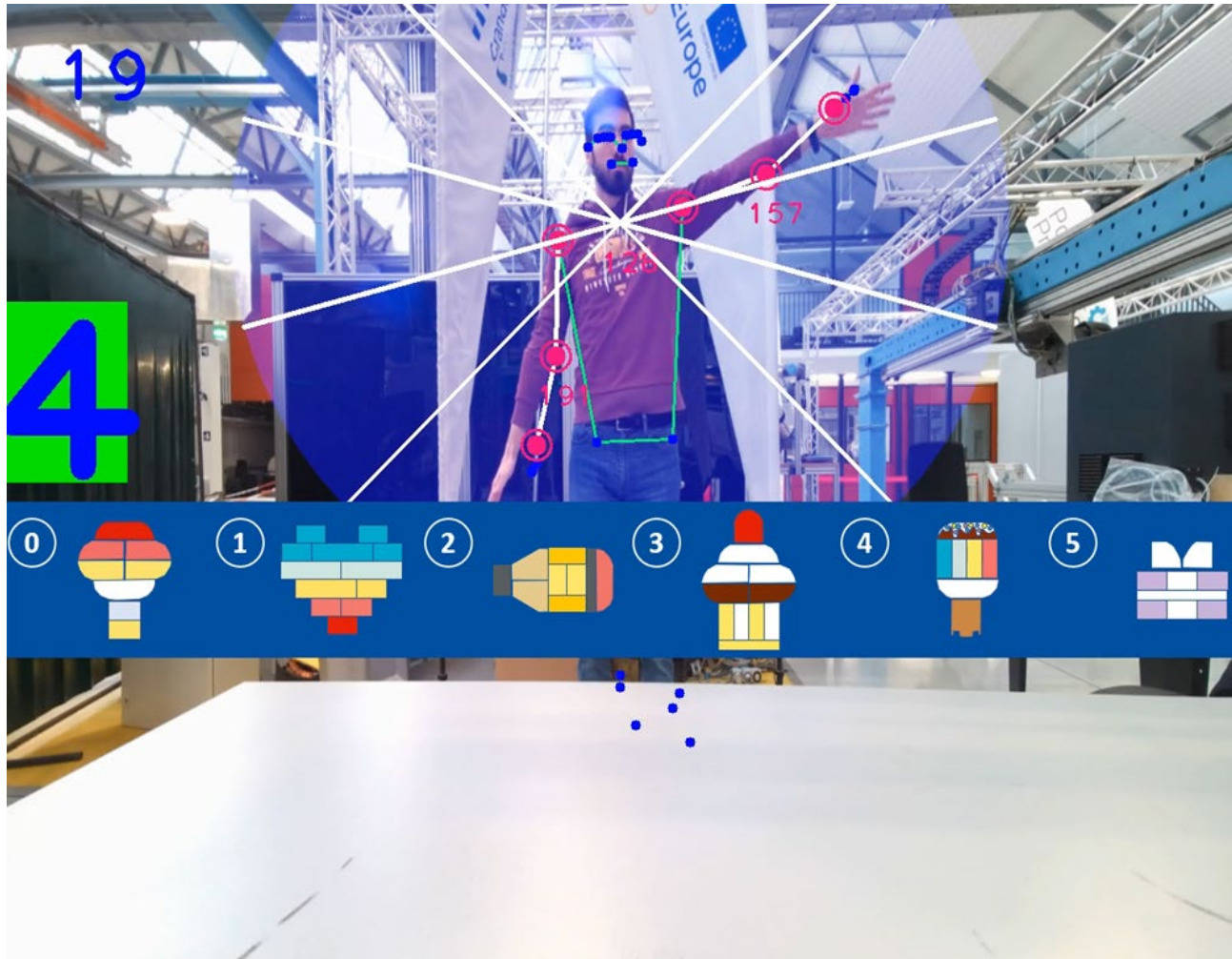
- Goal: Using the Body Tracking to choose an assembly groups from multiple assembly group.
- Step 1: Draw the Keypoints
- Step 2: Get each Keypoints pixel coordinates in list
- Step 3: Two Arm to be straight, when nodes 11, 13, 15 and nodes 12, 14, 16 to be straight, key points will become green.

Body Tracking Concept



- Step 4: If the angle θ between two arms bigger than 30° , virtual circle activates and prepare to choose the assembly groups.
- Step 5: Set the arm in different area 45° - 75° (3 or 6), 75° - 105° , (2 or 5) 105° - 135° (1 or 4), choose the human in the new group.
- Step 6: Each number means a different assembly group to choose.

Body Tracking with choosing an assembly group

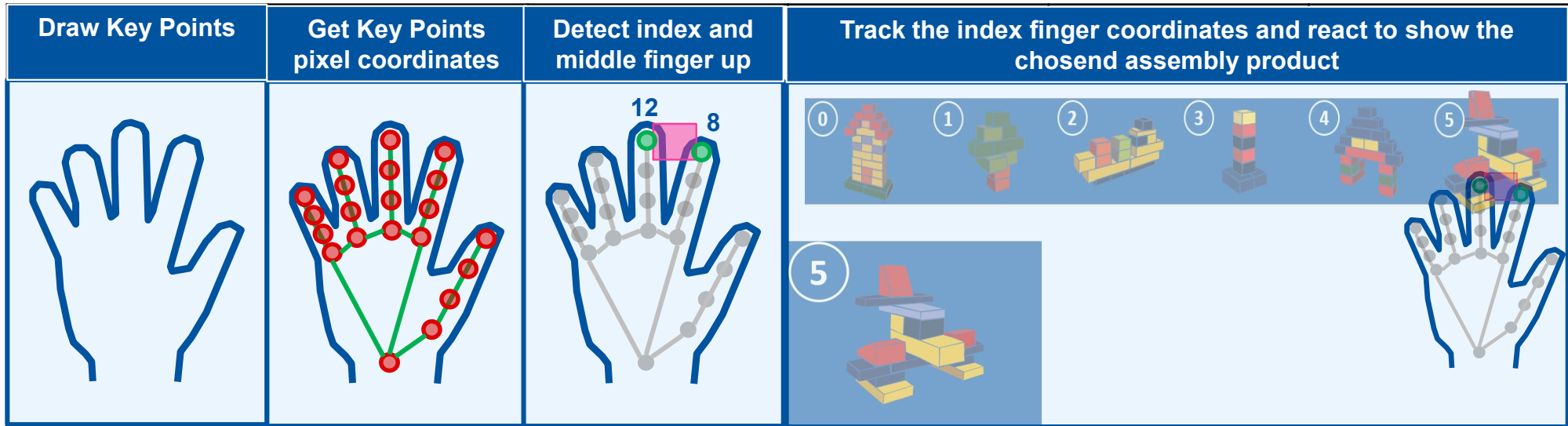


- Put the arm in each area and make sure each number can be used for choose the correct assembly group
- Try to let the arm in a non straight configuration and check if the keypoints will be green or not
- Try to make the angle between left arm and right arm less than 30 degrees and check if virtual circle can be activated or not.

Agenda

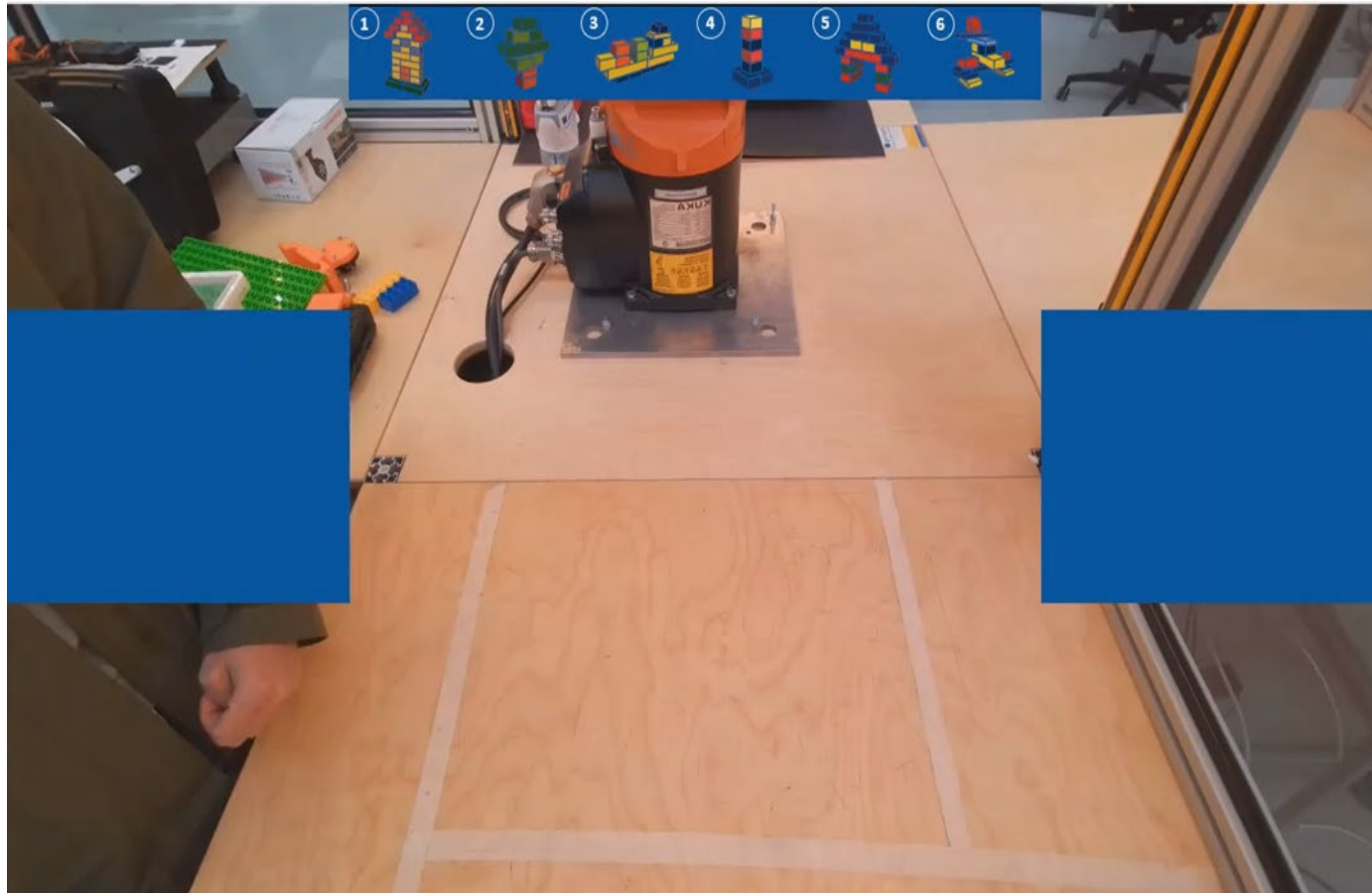
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Hand Tracking Concept



- Goal: Using the Hand Tracking to choose an assembly product from an assembly group.
- Step 1: Draw the Keypoints
- Step 2: Get each Keypoints pixel coordinates in list
- Step 3: Detect index finger (Keypoints: 8) and middle finger (Keypoints: 12) up and track between them a rectangle, now means the hand want to choose a product.
- Step 4: Track the index finger coordinates and in between Pos 0 to Pos 6 to show the corresponding products on the left lower corner and make the choosed assembly product to be bigger.

Hand Tracking with choosing an assembly product

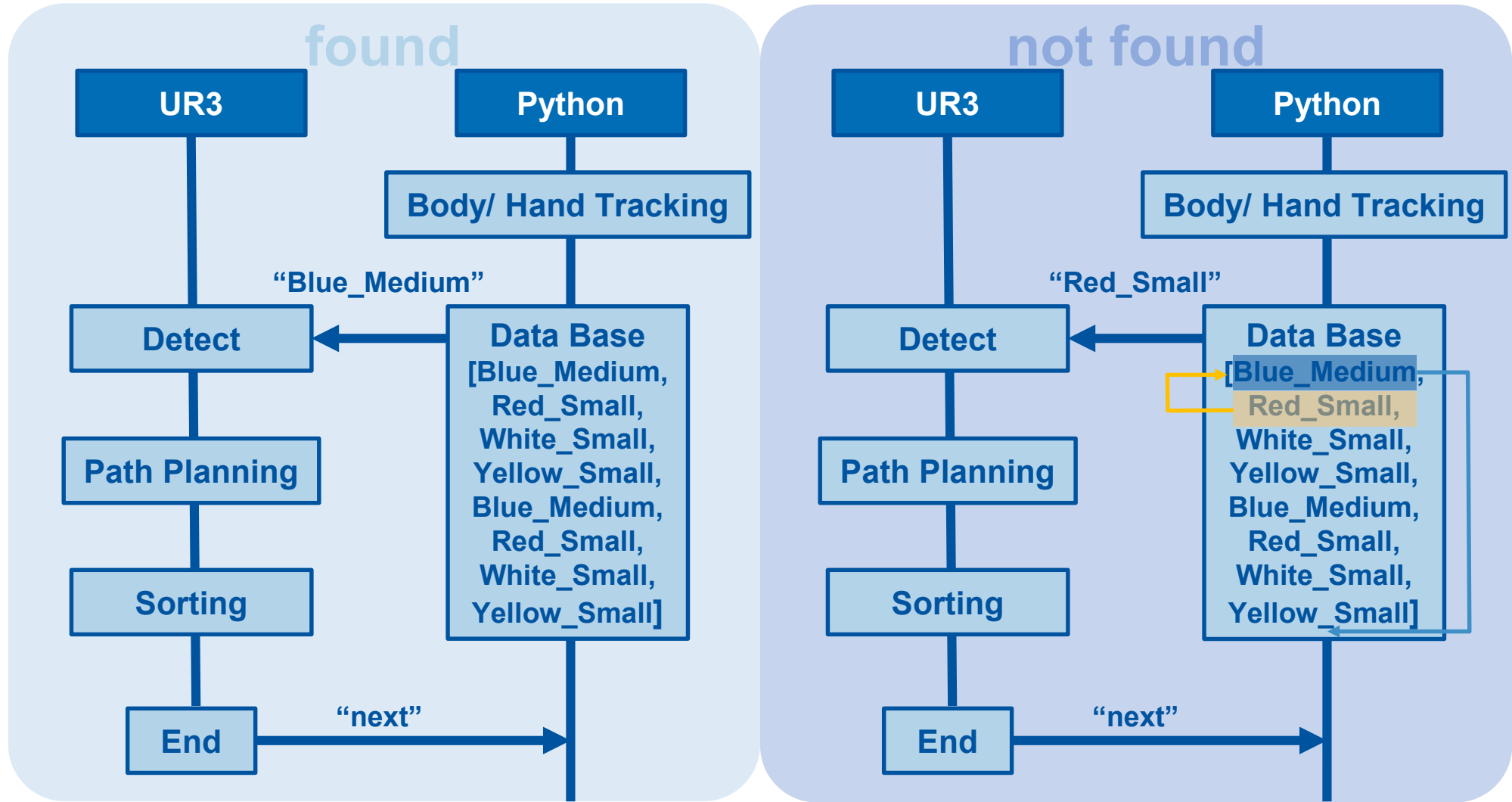


- Show a single hand and let the system detect to build the key points
- Put index finger and middle finger up and check if the rectangle is created
- Move the Hand with index finger and middle finger up and move through the assembly group menu and check if the assembly products are shown correctly.

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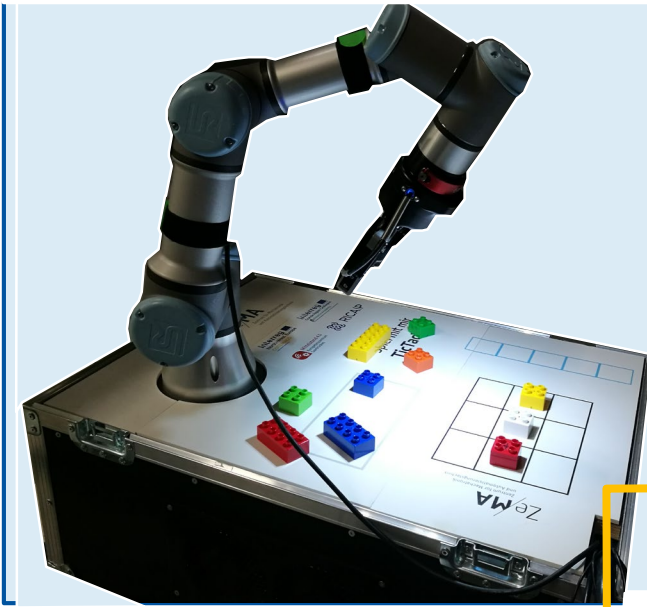
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Communication Logic

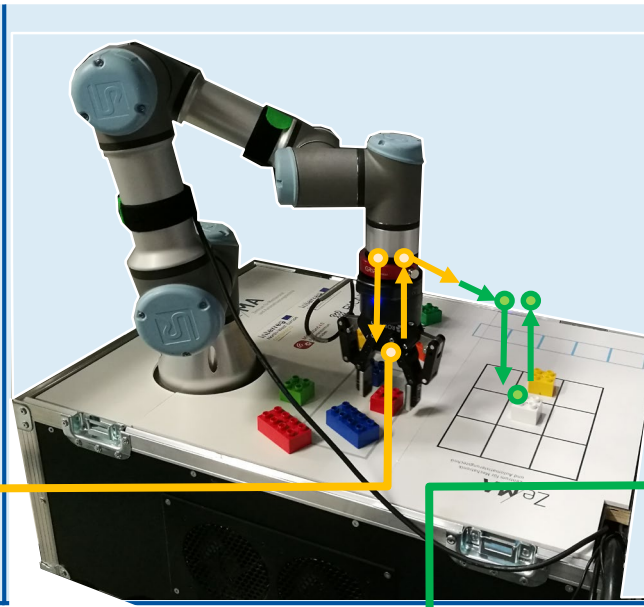


Path Planning/ Sorting

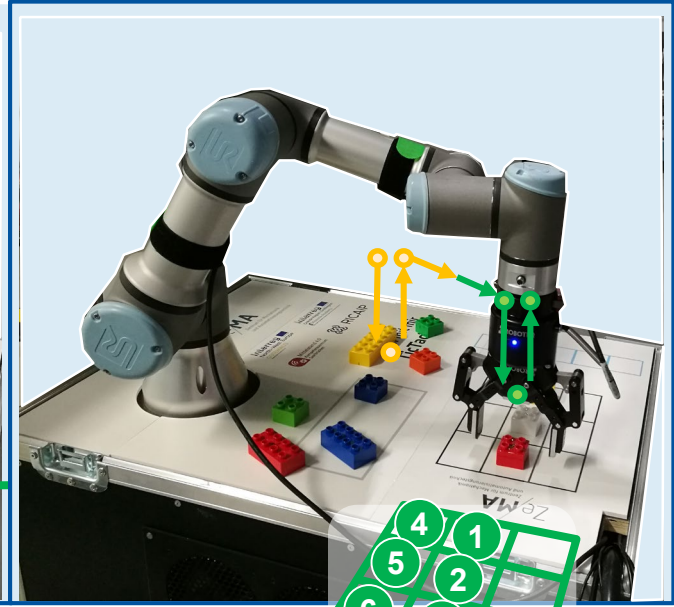
Detect LEGO Part



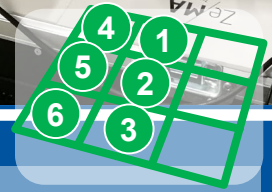
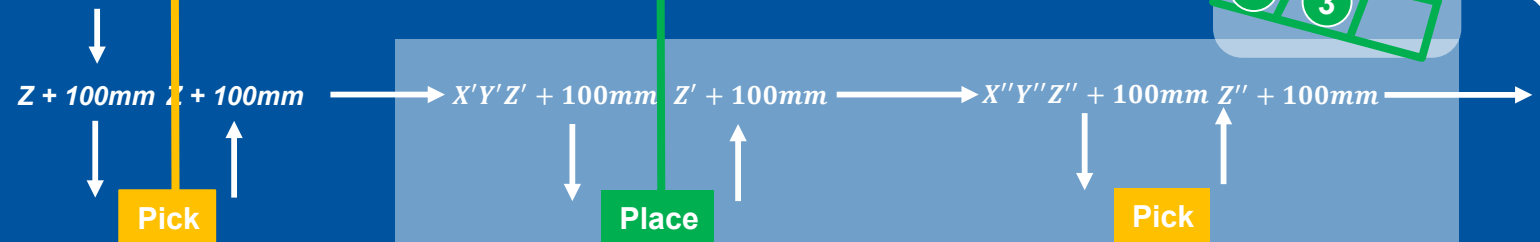
Pick

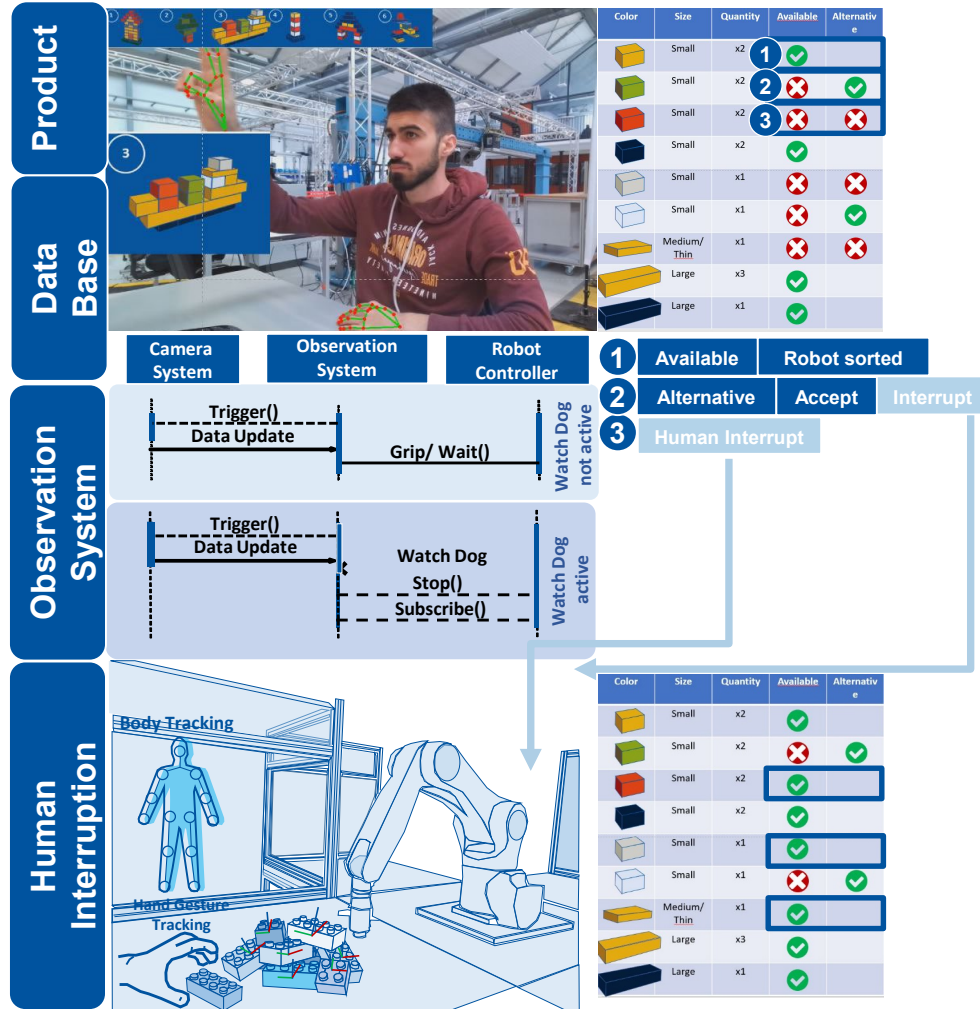


Place



Path Planning:





- This roadshow demonstrates an intelligent robotic system for sorting LEGO parts after the human wants to configure a product. After choosing the product, the data base of that particular product is generated.
- The observation system is activated to search for the parts. The robot begins then to sort the parts if they are available.
- If there are alternatives the system asks the client if it wants to proceed with the alternative or to interrupt.
- The human can interrupt when the parts not satisfied with the alternative one and not available
- Human interrupt means add, remove change and replace the parts. The observation system will synchronize the data base and the robot will continue sorting after interruption.