

Construction Supervision with Augmented Reality

Popular Science Summary of Master Thesis

Pablo Fernández Fernández

The automation field is growing more and more as technology becomes a more critical factor in our lives. Nowadays, a new trend is to convert all the industrial sector into digitization, with less physical personnel and more computerized work. So is that there is an exciting paradigm on digitizing the supervision of different machinery and constructions inside the industries. In this way, one manner of overseeing efficiently if a site is secure is using Augmented Reality and robots, so less human force is needed and better performance is acquired. Along these lines, an investigation and research of how to develop new algorithms and modules for augmented reality and robots seem to be suitable to improve supervision tasks.

In this sense, the Department of Automatic and Control at Lunds Tekniska Högskola has been interested in the integration of an automatic task for the supervision of its robot arms at the industrial lab called RobotLab. As a consequence, this Master Thesis [1] aims to create a software module for a commercial software, Unity, to recreate an Augmented Reality scenario where a specific robot arm is studied and simulated with the help of ROS (Robot Operating System). Furthermore, it is studied the integration of the commercial robot Spot, from Boston Dynamics, for carrying out the automatic mission of supervising the tasks performed by the robot arm.

In order to simplify the project, two different subtasks are considered.

On the one hand, for the creation of the Augmented Reality scenario a deployment of the 3D model of the robot arm (an ABB IRB2400 in this case) is needed. For this, two approaches have been considered. The first corresponds to the use of a software called Vuforia, which runs over the Unity engine and which contains the algorithm responsible for the tracking of an image, location where the 3D model can be built. An example can be seen in Figure 1.

Secondly, and due to the integration of Spot, Vuforia has been found to not be compatible with ROS so, as a consequence, a ROS-build package for the detection of a QR-code is applied. This can be observed in Figure 2.

On the other hand, the communication between the real robot and Unity (the Augmented Reality Engine) has been carried out by the use of ROS-build packages. Mainly, two of these packages (called *Robot Web Services* and *Externally Guided Motion*) are responsible for sharing the trajectories and positions of the real robot from its controller. Other packages

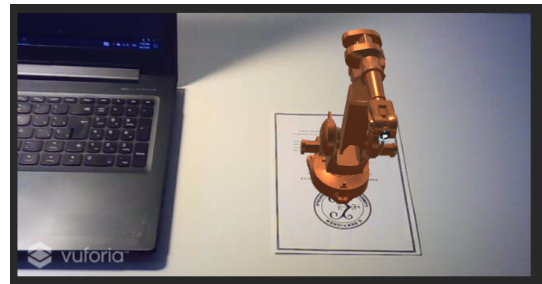


Figure 1. Image tracking with the use of the Vuforia software

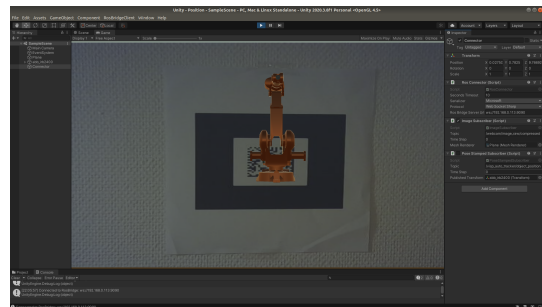


Figure 2. QR tracking by the use of a ROS-build package

considered correspond to the ones in charge of handling the use of three types of sensors: force, linear, and proximity.

In order to show the software module built on Unity with the deployment of ROS, it is shared the following videos, one showing the use of proximity sensors and ROS with a virtualization of the real robot and a second one displaying the simulation of Spot on a construction site where a QR detection is applied:

<https://vimeo.com/617397803>

<https://vimeo.com/656080766>

References

- [1] P. Fernández Fernández. "Construction Supervision with Augmented Reality". MSc Thesis TFRT-6154, Department of Automatic Control, LTH, Lund, Sweden. 2022. URL: <https://lup.lub.lu.se/student-papers/search>.