



# Visualization research

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## Introduction

In this file you will find the research on the best option as a visualization tool. The research was done with the [DOT framework](#), with this I want to show which tool is the best one to use with this project. The structure of this file is as follows: Questions; herein I tell about the main and sub-questions, What; herein I tell about what domain I am going to use in my research and why, Why; herein I tell what I want to find out and why, How; herein I tell how I obtain my answers, lastly the Conclusion; herein I tell what answer I have come to.

## Questions

Below is the main question I want to answer, it is then followed by a number of sub-questions.

### Main question

Which visualization tool is best to use for visualizing a conveyor belt?

### Sub questions

- Can this tool communicate with the Beckhoff plc?
- Can this tool be used on worse PCs?
- Is the tool easy to learn?
- Is the tool easy to use?

## What

During this study, I am only going to use the "available work" domain. The questions consist of questions that have already been answered several times by other people. To see if this is true I am going to try to conform them by testing them.

## Why

With this research, I want to find out which tool I can best start using for visualizing a conveyor belt. I have worked with a tool for this before, but I don't know if there are other/better alternatives to use. Since the visualization tool should be able to communicate with a Beckhoff PLC I would like to know if this is possible with the tool. In addition, I also want to know if this tool can be run on worse PCs. It could be that the program has to be run on another PC than mine, and this one could be worse than my PC. Also, I would like to get along well with a tool and also learn it easily. Per tool found, I would like to find out the above topics so that I can make a right choice based on all points.

## How

In this chapter, I explain the methods of research I will use to arrive at an answer to my questions. Almost all my research methods come from the "library method," herein I most easily get the right data. This is easy precisely because there were many predecessors before me, so everything has already been recorded once. The methods I use for this are [Available product analysis](#), [Best good and bad practices](#), and [Community research](#).

I then have to find out whether this is actually true, which I do by means of [document analysis](#).

## Unity

In this chapter, I answer the research questions I pose at the beginning of this paper. I do this from top to bottom, so I begin with: Can this tool communicate with the Beckhoff PLC?

### Can this tool communicate with the Beckhoff PLC?

I found some sources from communities that also wanted communication between Unity and Beckhoff PLC. In the communities I found, they all came to the answer that this was possible through the use of a dll. This contains a standard protocol developed by Beckhoff, ADS, this is made for communication with the Beckhoff plc.<sup>1</sup>

### Can this tool be used on worse PCs?

I found a resource that clarifies basic requirements for running the Unity editor. The general specs should be quite high for running Unity, the minimum recommended system is as follows:

- A CPU from either AMD or Intel of the latest generation with at least 6 to 12 Cores.
- A minimum of 8GB ram, 16GB is better.
- An NVIDIA RTX 3060 or an AMD RX 6600, both with at least 6GB VRAM.<sup>2</sup>

### Is the tool easy to learn?

As stated in one of the sources, learning Unity is quite difficult. There is a lot involved in making a game or visualization in Unity. But because there are so many resources and communities, there are also a huge number of places to get help from. Unity is based on C# scripts, in addition it can help to use simpler code editors. When you already have a basic knowledge of C#, it becomes easier to work with Unity.

Besides all these options, there are also a number of official tutorials of Unity or supported on Unity with which additional knowledge can be gained.<sup>3</sup>

### Is the tool easy to use?

Unity has a fairly simple to understand UI that helps in developing games and using Unity. In general, any beginner can start programming fairly easily. In addition, because there is a lot of content about Unity on the Internet, when you run into problems, it is also very easy to find a solution to your problem. In addition, it is also easy to follow a tutorial or something similar to understand the basics of Unity.<sup>4</sup>

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<sup>1</sup> <https://answers.unity.com/questions/322235/unity-3d-android-application-work-with-usb.html>  
<http://dronefactory.co.uk/?p=43>

<sup>2</sup> <https://www.cgdirector.com/unity-system-requirements/>

<sup>3</sup> <https://learn.unity.com/courses>  
<https://whatsabyte.com/learn-unity>

<sup>4</sup> <https://inspirationtuts.com/is-unity-good-for-beginners/>

## Unreal Engine

In this chapter, I answer the research questions I pose at the beginning of this paper. I do this from top to bottom, so I begin with: Can this tool communicate with the Beckhoff PLC?

### Can this tool communicate with the Beckhoff PLC?

It is possible according to the sources I found to connect to a Beckhoff plc via Unreal Engine. Again, this is possible using the ADS communication developed by Beckhoff. Setting up communication between the two platforms is a lot trickier, though, because Unreal Engine cannot load dll files. In the source found, a company changes the ADS protocol to something useful for Unreal Only that I can't access.<sup>5</sup>

### Can this tool be used on worse PCs?

Unreal Engine 5 (the current version of Unreal Engine), despite requiring fairly low specifications, is still quite heavy to run. Unreal Engine does not require a tremendously good PC but there are some points that the PC must meet, these are as follows:

- A CPU Intel 7th generation or equivalent.
- A minimum of 8GB ram, 16GB is better.
- An GTX 1080 (or AMD equivalent) or GTX 3000 series (or AMD equivalent) if possible, both with at least 8GB VRAM.<sup>6</sup>

### Is the tool easy to learn?

Based on the sources found, Unreal Engine is not very difficult to learn. There is not much code involved in creating a visualization or game. There is a drag and drop system that allows you to visually make objects interactive. Learning to work with the IDE, according to the sources I found, is a bit more difficult though, overall it is not a big task to learn to use for beginners.<sup>7</sup>

### Is the tool easy to use?

As can be read in the previous chapter, using Unreal Engine is not enormously difficult. Part of learning is also using the IDE, using the IDE is also not very difficult, according to these sources. To get Unreal Engine 5 you only need to download it and log in, then it is possible to get started. Creating a visualization or game is also very easy due to the drag and drop system. The only thing that requires a little more effort to learn is the layout and functions of the IDE, these are a little trickier to get through. Overall, it is not difficult to use Unreal Engine.<sup>7</sup>

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<sup>5</sup> <https://uia.brage.unit.no/uia-xmlui/bitstream/handle/11250/3021475/no.uia%3Ainspera%3A109927222%3A24214298.pdf?sequence=1&isAllowed=y> (page 34, chapter 3.4.1 TwinCAT Communication)

<sup>6</sup> <https://docs.unrealengine.com/5.0/en-US/hardware-and-software-specifications-for-unreal-engine/>  
[https://en.as.com/meristation/2022/05/18/news/1652904132\\_808189.html](https://en.as.com/meristation/2022/05/18/news/1652904132_808189.html)

<sup>7</sup> <https://www.quora.com/Is-Unreal-Engine-5-a-viable-starting-engine-for-beginners>  
<https://educationspeaks.org/is-unreal-engine-easy-to-learn/#:~:text=Yes%2C%20Unreal%20Engine%20is%20beginner,engine%20easier%20than%20ever%20before>

## Simatic WinCC

In this chapter, I answer the research questions I pose at the beginning of this paper. I do this from top to bottom, so I begin with: Can this tool communicate with the Beckhoff PLC?

### Can this tool communicate with the Beckhoff PLC?

The resource found explains how to make secure communication between a Beckhoff PLC the Simatic WinCC program. The communication is then not via ADS but via the OPC UA protocol.<sup>8</sup>

### Can this tool be used on worse PCs?

In general, I cannot find that Simatic WinCC requires a good PC, the minimum specifications are also very low. To run it you need the following minimum:

- A CPU Intel Core i5 / i7 2.8 GHz or equivalent.
- 8GB ram.<sup>9</sup>

### Is the tool easy to learn?

Unfortunately, I have been unable to find clear sources on the ease of use and learning for this section. All I could find were a few reviews saying that it is generally a fairly easy tool to use. I can't confirm this well so I just have to go by what I have read in the reviews.<sup>10</sup>

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<sup>8</sup>

[https://support.industry.siemens.com/cs/attachments/109772341/109772341\\_Communication\\_Beckhoff\\_OpcUa\\_DOC\\_en.pdf](https://support.industry.siemens.com/cs/attachments/109772341/109772341_Communication_Beckhoff_OpcUa_DOC_en.pdf)

<sup>9</sup>

[https://www.winccoa.com/documentation/WinCCOA/3.18/en\\_US/WCCOA\\_Voraussetzungen/Voraussetzungen-02.html](https://www.winccoa.com/documentation/WinCCOA/3.18/en_US/WCCOA_Voraussetzungen/Voraussetzungen-02.html)

<sup>10</sup> <https://www.gartner.com/reviews/market/scada-software/vendor/siemens/product/simatic-wincc>

<sup>11</sup> <https://www.gartner.com/reviews/market/scada-software/vendor/siemens/product/simatic-wincc>

## Conclusion

After researching everything and since I already have a lot of knowledge of C#, I think for this project the easiest thing to do is to use Unity instead of one of the other visualization tools. Unity compared to the other two also has many other features, and also a lot larger community where questions can be asked or answers found. In addition, it is also very easy to work with Unity's IDE, so it is easier for another group to go further into the task.

Unreal Engine follows second, this is because no real programming is required here. But if it should, this is in C++ something I would still have to learn in the short time this project has. So that would not be very convenient.