MANUS™

# 1. Introduction

The possibility of transporting oneself to a different world has always been a dream of many. In the past, the best way to do this was to read a book and let your mind do the rest. Nowadays, with the help of VR, this dream has come even closer to reality, where not only your mind, but your vision is transported as well. In the quest of making this experience even more authentic to the user many different methods have emerged, as for example Haptics (the usage of vibration or other methods to simulate touch), or 3D sound. These techniques are aimed towards the improvement of the user's own physical feeling, but what happens when multiplayer is introduced to VR? How does one express their virtual self to others? Currently it is possible to download a 3D skin from the web that can be used for this purpose, but as fun as it may sound for one to look like a game or movie character it is hardly professional in a business-oriented environment. For this reason, a way to convey one's own, real physical self must be introduced.

Manus, the company in which this project will be conducted, has created an application, called Connect, which can be used to showcase Computer-aided design (CAD) models in VR. Since this application will be multiplayer enabled a problem is introduced, where the users will not be able to recognize each other. Currently, this problem is investigated by several companies, but none have come up with a steadfast solution that can be used freely.

In this project, the goal is to research and potentially create a 3D head reconstruction solution, which if successful, can later be expanded to full body reconstruction and dynamic facial expression capturing. This is the global objective of the company. Whether the internship goal will be expanded to include these tasks or this will be done outside of the internship depends on the time the initial task will take.

In the following chapters an introduction to the company will be given, then an overview of the assignment, followed by a chapter about the implementation process. Finally, you can read about the conclusions I have reached and the recommendations that I can give for further development. **(TO DO)**



I think you should also explain 3D sound

you should leave this out, and close to terminating the report, maybe come here and rephrase (if you managed to do more or not)

recommendation: mind the usage of I in report, try to use it only when you support and emphasise own point or outcome (e.g. in results section)

# 2. About the company

Manus was founded in July 2014, then going by the name Manus Machinae. At that time, the company was situated at Strijp-S in Eindhoven. With the rise of VR, which was then used with a mouse and keyboard/console controller, it was evident that a new way of input was required, so Manus decided to create a glove prototype that would fulfil that requirement. Their plan was to create a full 360-degrees, occlusion free, analogue hand tracking.

Since then the company has gone through several overhauls, where it first changed its name to Manus-VR, while it is currently trying to go with Manus only, as they are moving away from being a strictly VR company.

Since their inception, Manus has moved to the Business-to-Business VR Training & Simulation and the Motion Capture industry, as the VR consumer market is still not mature enough to be re-entered.

Currently, Manus has relocated in a brand-new office in Geldrop, where it houses its 36 employees. With a €3.1 million in investment and a solid revenue Manus is making a mark in the Motion Capture industry by supplying low-cost and effort full body mocap solutions with hand tracking. (Witteveen, 2020)

## 2.1. Products

Manus has several products, which concise of several gloves and a full-body motion tacking software, as can be seen in Figure 1.

**Figure 1 Polygon (Left), Prime II Xsens (Middle-left), Prime Mocap (Middle-right), Prime Haptic (Right) Retrieved from the Manus Website**

### 2.1.1. Polygon

MANUS Polygon is a full-body tracking software that enables the user to translate each of their movements in any virtual environment. By tracking 6 data points, it makes use of inverse kinematics, which is the science of predicting how joints in a body would move based on endpoints it is connected to (e.g shoulder and hand), to emulate natural body movements in real-time. (Polygon, n.d.).

I would put this as a second subsection to have it as a connecting paragraph to the actual assignment, since you work in Polygon

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I am still missing the main research question, it has to contain the essence of this project; an example: "Can 3D head reconstruction be done with commercially available technology?"
Think about this and try to formulate it

### 3.3.4. Questions and br

Considering the strategy and the
with a different degree of speci
questions and how they will be tackled will be stated in this section.

- ❖ Has 3D Head reconstruction been tackled before by peers and how?
  - Research methods to be used: "Community research", "Literature study" and "Expert interview"
- ❖ Is this possible in the current scope of the project with regards to hardware?
  - Research methods to be used: "Stakeholder analysis", "Expert interview", "Community research", "Available product analysis"

Sub-questions and their breakdown will be specified further in the report when they arise.

you should mention the sub-questions here if you already know them

- Does it work with human heads (examples were of inanimate objects)?

Both of these questions would be answered with the "Component testing" and "Community research" research methods.

1-10 numbers you write

## 4.2. Photogrammetry software testing

### 4.2.1. Initial tries in Meshroom

The initial step would be to test how the software works through the GUI as to validate its functionality. Multiple photos of different objects, including a person from different distances were taken and put into Meshroom. The software is easily operatable as one just needs to input images and press the play button. First tries were made with large number of photos (150-250), which meant that it would take up to 3 hours for a single reconstruction to be done. As user experience had to be considered this was not a favourable outcome. What is more the reconstructions themselves left much more to be desired.

Figure 6 Chair reconstruction

In Figure 6 an example can be seen where a chair is the main point of interest but it is not rendered correctly. The ground around it however - is. Having in mind that only a head needs to be reconstructed in the initial assignment, a way to remove the background had to be found. Another example can be seen in Figure 8 . This reconstruction was made of two hundred images taken in