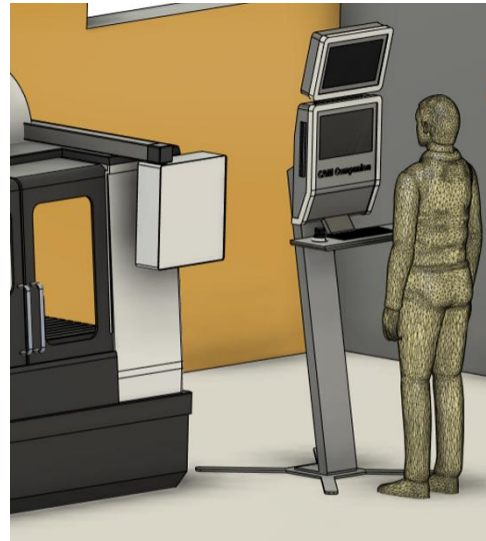


Designing a modular CAD/CAM add-on module for CNC machines

Many production companies that produce metal parts or products use CNC (computer numerical control) machining as their main production technique. Often this means that milling machines are used with a broad range of tools. Through the usage of CAD (Computer aided design) and CAM (computer aided machining) software the products are designed and prepared for production. At many companies the programming of the operations of the machine is done in an office. Running the software requires a computer that has the right specifications which is often not suitable for placement in a workshop. These PC's are relatively expensive and fragile, logically this does not match well with a working environment where dirt, metal chips or other debris are present. Besides that fact, a



desktop also requires a dedicated work station, in practice this is not always possible in a workshop because of space limitations or because it might form an obstruction for the employees. Because of this there often is a physical distance between the CNC machine and the computer on which changes have to be made when errors are made during the programming in CAM software. This means that the operator of the machine must walk back and forth each time a change is required. The extent in which this is considered a problem differs greatly between companies. It is dependant on the layout of the workshop and what products are being produced. The layout determines the distance to the PC and the product that is being produced will directly influence how often a change is needed per product. Through research performed in this thesis it has become clear that it is a problem experienced by many companies. It results in inefficiency in the production whether the company is aware of it or not. A solution for this problem is to give access to CAD/CAM software to the operators close to the machine. Which is exactly what the client of the project, CAM Consult, wants to bring to the market.

CAM Consult is a consulting company for firms that work with CNC machines and use Fusion 360 as their CAD/CAM software. Courses are held to increase clients' knowledge of the program and by doing so increase their efficiency in the workshop. Besides that CAM Consult also visits their clients when problems arise with post-processing or communication between the PC that is running Fusion 360 and the machines.

The product that has been designed in this project aims to make CAD/CAM software available next to the CNC machines. The product is an add-on module that can be placed in the workshop next to the machines. The operators can use the module while standing. It supports a display, keyboard, mouse and 3D mouse. The product is modular to fit to the wishes of specific clients. The client can choose whether they wish to have extra displays, touchscreen, built-in keyboard and if the product will be supported by a stand or is suspended and attached to a (CNC) machine. During the project a prototype and configurator model in Fusion 360 have been developed. Subsequently, these have been tested and evaluated at target companies to find the perceived value of the product. The results were mixed. The conclusion is that the product is valued most at high mix/low volume production companies. Since there the operators tend to work with CAD/CAM software the most in their daily operations. Having easy access during the operation of the machine could significantly increase their overall efficiency. It should be noted that the product has been evaluated at two companies. This means that the data gained from the research is of value for further development of conclusions about the whole client base of CAM consult.

the product but should be critically looked at since it is an insufficient amount of data to arrive at

