

The design of a waterproof sensor plug (...)

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The bachelor assignment was commissioned by Heves Engineering B.V. to develop a product solution for one of their machines. Apart from the design of the product, research is done in possible applications and related industries who could have beneficial advantages from the product as well. This is because the product might also be interesting for other markets.

Heves engineering (Heves) is a company that provides innovative engineering solutions to companies. They visit the client and work there to get a better insight into their client's problem. A design solution is worked out by Heves after the research at the client.

During the development of one of their machines, they found a problem of which there is no product currently on the market. This product must function as sensor plug in a tank. The tank is filled with a fluid and specific substance. Because Heves is planning to ask for a patent on the product idea and design, a part of the research question and full thesis title is left out as well as further details about the sensor plug and function.

A research question and related sub-questions are determined to research the potential industries, applications, principles, technical systems and already existing connections related to sensors. After the research, requirements are set such that the product is also generally usable.

With the requirements in mind are ideas sketched and worked out in more detail to eliminate some of the initial ideas. This required some calculations to obtain the pressure on the sensor surface and a calculation to design a suitable spring. The spring and pressure calculations showed that the current concepts would not work and so new concepts were designed.

The new concepts solved the spring issues. The pros and cons were listed to choose the best concept. To be able to 3D print the chosen concept were some test prints conducted. Those test prints gave insights into the tolerances of the FDM printer and a first 3D model was printed. The next step was to determine all the details of the product like the design of a suitable O-ring and the design of a proper connection that would fit most fluid tanks.

Some pressure simulations were done on one of the product parts to make sure that it can resist the high-pressure conditions of 16 bar. When the product was fully defined an SLA printer was used to produce a prototype. The prototype was used to test if the product is watertight, if it would affect the measurements by the sensor and to do some user tests.

Out of the tests came some results which lead to some small issues. Those issues, including suggested solutions, were discussed in the discussion as advice to change or to do further research.

For the production, some research is done in injection moulding, additive manufacturing and turning and milling. Those three options seem to be a suitable production method. The belonging suitable materials are mentioned and a graph for the cost per product related to the batch size is made.