

# Creating a more ergonomic, efficient, and effective integration for the EasyCompounder system

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Some people need personalized medication because mass-produced medication is not suitable. This personalized medication is made by small scale compounding, which is done in compounding pharmacies. SmartCompounders B.V. is a specialized company in Enschede, which develops devices that can semi-automate the compounding processes. The EasyCompounder has been developed to fill the gap in the market of compounding devices. The current devices are not ergonomic, and the processes done by hand can also be made more efficient, effective and ergonomic.

The EasyCompounder consists of several modules which can be used to fill syringes, fill vials, withdraw medicine from a vial with a syringe, and compound Total Parenteral Nutrition (TPN) mixtures. Although the modules of the EasyCompounder system are working together properly, they do not form one coherent system. So, SmartCompounders B.V. asked for an integration of these modules. The research question is formulated as: “How can the pharmacists work with the EasyCompounder system in an ergonomic, efficient, and effective way?”.

First, some more background information was gathered, and then in-depth analyses were conducted. The most ergonomic working postures were defined, which are later incorporated into the system. By doing literature research common causes of errors and how to prevent them were discovered. Task analyses were conducted and the concerns which came forward out of these were used as input for an FMEA. The FMEA showed that the chance of placing a tube incorrectly can be reduced by showing how to place tubes in the pinches of the TPN module, and how to place tubes in the pumps. It also showed that a new holder for the ingredient containers is desirable. Based on this and some conversations with the client the requirements for all the modules could be defined.

The integration is created by developing one main holder to which other holders can be connected. This way the worksurface stays as empty as possible and the system stays flexible. The height-adjustable holders enable the user to adapt the device to their preferences. The device is ergonomic because it can be used by both left- and right-handed people, all the components are within reaching distance, the repetitions are taken away, and the modules weigh not more than 6 kg.

For a more ergonomic placement of the ingredient containers, a square tube can be connected to the main holder. Bottle holders, suitable for multiple sizes of bottles, and hooks for the IV bags can be slide on this square tube. A special holder for the TPN module can also be connected to the main holder. The TPN module can be easily hung on this holder, by means of two knurled screws on the back of the TPN module. In order to lift the adapter from the work surface, it can also be placed in a holder. To lift the cables and tubes from the working surface small click-holders are added.

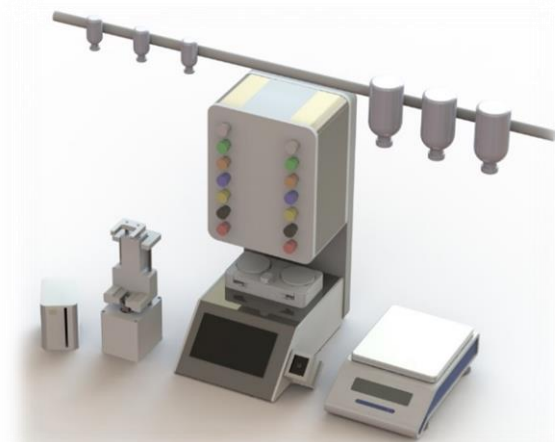


Figure 1: The First idea for the EasyCompounder system



During the integration process, the filler was created. The Filler can be used to fill syringes, vials, and can withdraw fluid from a vial with a syringe. To do so only the setups have to be changed. The Filler should also be lifted from the work surface. An idea for this has been created but is not worked out yet, because of time limitations.



Figure 2: The final EasyCompounder system

To make the system more effective and efficient the chance of making mistakes is reduced by incorporating a camera and label printer. An air bubble detector is added to improve the quality and accuracy of the mixtures. To prevent connecting mistakes the tubing set for the TPN module and the pinches in the TPN module are colour coded and numbered. In the pump's arrows will be engraved which show how the tubes should be placed.

There are still some points of improvement because within the time frame not everything could be optimized, and some things did not fall within the scope of the project. It was discovered that there is a possibility that ingredient fluid stays behind in the tubes after flushing the tubes with flushing fluid. It should be tested what the flushing speed and volume need to be in order to be 100% sure that there is nothing else in the tubes than the flushing fluid. Besides this, it should be tested if the bottle holder needs an addition of a click system or a ridge with provides friction, to make sure the bottles stay better in place. Finally, it is advisable to test the new modules as soon as their first versions are done. This way it will be easier to adapt them and the best solution for the pharmacists can be created.



Figure 3: Indications in the pump

