

## KOKKUVÕTE

Käesoleva lõputöö peamine eesmärk oli muuta Stockmann AS poolt tellitud UV-C valgusel töötav desinfitseerimisseade hügieenilisemaks ja kasutajasõbralikumaks. Selleks pakkus autor välja viis lahendust, mis vähendaksid vajadust kasutajal seadet katsuda. Vähemal füüsilisel kontaktil masinaga väheneks mikroobide ja viiruste levik seadme pindadel ning seadme kasutamine muutuks mugavamaks.

Esimeses peatükis kirjeldab autor viit võimalikku lahendust, millest hindamismatriksi abil seejärel üks välja valiti. Hindamiskriteeriumiteks olid olulisuse järjekorras ohutus, töökindlus, hind, kompaktsus, välimus ja hoolduskulud. Valituks osutus lahendus number 2, mis sai maksimaalsed hinded kahes olulisemas kriteeriumis - ohutuses ja töökindluses. Ohutuse puhul hinnati inimese tõenäosust tervisele kahjuliku UV-C kiirguse kokkupuutumiseks. Lisaks hinnati ohutuse puhul traumade esinemise tõenäosust seadme kasutamisel. Töökindluse kriteeriumis hinnati riski seadme komponentide purunemiseks.

Teine peatükk hõlmab endas seadme projekteerimist, milleks kasutati Solidworks ja Autocad tarkvara. Korpuse projekteerimisel võttis autor arvesse, et parima välimuse saavutamiseks peaks nähtavale jääma võimalikult vähe kinnitusvahendeid ning elektroonikat. Samas on ka oluline, et elektroonika oleks kaitstud plastikut rabestava UV-C kiirguse eest. Elektroonika kinnitamiseks keevitatakse seadme sisemusse keermelatid, mille külge saab elektroonika mugavalt mutrite abil kinnitada. Vajalikud poldid, mis pidid jääma seadme välisele küljele, peideti põhja ja tagumise külje peale. Peatükis on selgitatud ka elektroonika valikut. Steppermootorite väljavalimiseks arvutati eelnevalt vajalik pöördemoment ja kiirus. Täielikult puutevaba seadme saavutamiseks on esipaneelile lisatud optiline andur, millega saab ukse liikumist juhtida. Kirjeldatakse ka seadme kasutamise protsessi. Toidukarbi desinfitseerimiseks tuleb kasutajal anum seadmesse asetada ning optilise anduri ees viibata, misjärel uks sulgub ning algab UV-C kiirgusega valgustamine. Masin annab indikaatortule kustumisega teada, et kiirgusega valgustamine on lõppenud ning kasutaja saab ukse viibates uuesti avada. Seejärel uks avaneb ja kasutaja saab võtta desinfitseeritud toidukarbi.

Kolmandas peatükis tuuakse välja autori poolt koostatud juhend desinfitseerimisseadme kasutamiseks, mis annab kasutajale instruksioonid seadmega töötamiseks. Erilist tähelepanu on pööratud kasutaja ohutusele. Lahti on seletatud seadme väärkasutamisega kaasnevad ohud, mis võivad põhjustada tõsisid kahjustusi nii kasutajale kui ka seadmele. Neljandas peatükis on tabelina välja toodud

ühe seadme omahind, milleks on 1082,60 €. On oluline märkida, et hind ei sisalda kontrolleri hinda.

Tulevikus tuleb välja valida kontrolleri, mis jäi selles töös valimata. Käesolevas töös lahti seletatud kontrolleri tööpõhimõtte lihtsustab kontrolleri valikut ning on abiks selle programmeerimisel. Põhjalikumat kontrollimist vajaks töös kirjeldatud stepper mootori - mootori pöördemomendi ja kiiruse suhte graafikut tuleks võrrelda tegelikkusega. Samuti tuleb kontrollida, kas mootori võll peab vastu mootori tootja poolt paika pandud maksimaalsele pöördemomendile.

## **SUMMARY**

This bachelor's thesis' goal was to improve usability and hygienic conditions for a disinfection device with an UV-C light, which was ordered by Stockmann AS. The author came up with five solutions that would reduce the need to physically touch the device. With less physical contact to the device, the spread of germs and bacteria on its surfaces would decrease. With less need for physical contact with the machine, the usability of the machine would increase as well.

In the first chapter, the author describes five different possible solutions and chooses the best option with the help of an evaluation matrix. The evaluation criteria by importance were as follows – safety, reliability, price, compactness, appearance, and cost of maintenance. Based on the matrix, solution number 2 was chosen as the best option. It got maximum points in two of the most important criteria – safety and reliability. In the safety criterion, the chances of the device's user being exposed to the UV-C light while using the device were assessed. The chances of the user being injured while using the device were also considered. In the reliability criterion, the risk of the device's components breaking was assessed.

In the second chapter, the process of the device's designing is described. Solidworks and Autocad software were used for designing the device. When designing the shell, the author figured that the appearance of the device would be better if fasteners and electronics were hidden. It is also important that the electronics are protected from the UV-C light, which can make the plastic brittle. Threaded bars will be welded into the device's interior, so the electronics can easily be fixed into place using nuts. To have less bolts visible, the author placed them on the device's backside and bottom. In this chapter the choice of electronics is also explained. To choose suitable stepper motors, correct torque and rotational speed were calculated beforehand. In order to achieve a fully touch-free device, an optical sensor was placed onto the front panel for controlling the door movement. The process of using the device is also described. To disinfect the reusable food container, it must be placed into the device. Then the user must wave in front of the optical sensor, which signals the device to close the door and start the UV-C lighting process. When the disinfection process is done, the indicator light will turn off which shows the user that the device has finished. Then the user needs to wave in front of the optical sensor again and the device's door will open.

The third chapter consists of the user's manual for the device. The user's manual gives instructions on how to use the device. Special attention has been paid to the user's safety. The dangers of misuse have also been brought out, as they can cause serious

damage to both the user and the device. In chapter four, the device's manufacturing cost of 1082,60 € is calculated. It is important to mention, that the cost does not include the price of the controller.

In the future, a controller must be picked, as it was not chosen in this thesis. The controller's working principles are described in this thesis, which simplifies the process of choosing a controller and will be helpful when programming it. The stepper motors require more thorough inspection – the graph containing the motor's torque and rotational speed should be compared to the reality of it. It is also important to check if the motor's shaft withstands the motor's manufacturer's alleged maximum permissible torque.