4. KOKKUVÕTE

Lõputöö ajendiks oli autori soov arendada robootikavõistlustele sobilik konkurentsivõimeline robot. Peale 2021 Robotexi võistlust hakkas lõputöö autor planeerima folkrace roboti ehitamist ja sellele komponente valima. Algandmetena kasutati Robotex International võitluste reegleid ja seal varem edukalt osalenud robotite omadusi. Algandmete põhjal sai esialgsete arvutuste baasil välja selgitatud peamised näitajad, mille alusel sai hakatud otsima mehaanika ja elektroonika komponente. Hoolega võrreldi erinevaid turul saadavalolevaid komponente, et robot oleks ka reaalselt võimeline hiljem liikuma ning, et kõik detailid sobiksid omavahel kokku. Peamiste mehaanikakomponentide ehk mootorite ja tähtsate elektroonikakomponentide (andurid, mikrokontrollerid, aku ja muu) valimise peale kulus ligikaudu kuu aega. Seejärel mõne nädalaga valmisid esimesed eskiisid, mudelid roboti kerest ja komponentide paigutusest. Ruumi kokkuhoiu mõttes ja töökindluse tagamiseks valmistas autor ise trükkplaatide disainid, millele kulus algselt samuti ligikaudu paar nädalat. Trükkplaadi disaini valmimise järel tehti viimased viimistlused mehaanika disainis ja hakati roboti kere ning muid detaile tootma. Pisemaid mehaanika disainimuudatusi tuli koostamise käigus teha, kuid suures plaanis jäi roboti disain samaks, millisena see algselt planeeritud oli. Seejärel saabusid juba trükkplaadi toorikud, millele tuli hakata ükshaaval komponente külge jootma ja katsetama. Ka seal esines pisemaid vigu ühendamata jäänud ühenduste osas, kuid need sai kergelt lahendatud. Kui mehaanika ja elektroonika oli eraldiseisvalt valmis siis algas integratsiooniperiood, mille raames ühildati mehaanika ja elektroonika ning algas tarkvaraarendus, millest viimane võttis kõige rohkem aega. Tarkvaraarenduse käigus selgusid mõningad väikesed vead mehaanikas ja elektroonikas, näiteks trükkplaadil mõne ühenduse puudumine. Suurimate probleemide lahenduse järel algas katsetusperiood, kus ehitati testrada robotile katsetamiseks ning prooviti läbi erinevaid olukordi, mis võistlustel võiksid ette tulla. Testimise algfaasis veetis robot palju aega seinte ääres kinni, kuid mida aeg edasi, seda paremini suutis robot rada läbida. Testimise lõpufaasis suutis robot juba küllaltki hästi rada läbida, kuid probleemikohtadeks kujunesid laiad rajaosad, kus võis esineda pöördeid. Robot võis sellistes tingimustes hakata tagurpidi rada läbima. Selle vältimiseks oli küll robotile lisatud güroskoop ja kiirendusandur, kuid selle tarkvaralise implementeerimiseni lõpuks ei jõutud. Lõplikult on autonoomne folkrace robot sõiduvalmis, aga paranduskohti leiab igas valdkonnas.

5. SUMMARY

The motivation of the thesis was the author's desire to develop a competitive robot suitable for robotics competitions. After the 2021 Robotex competition, the author of the thesis began to plan the construction of a folkrace robot and select this component. The rules of the Robotex International fights and the characteristics of the robots that participated there before were used as initial data. Based on the initial data, the main indicators were determined based on preliminary calculations, on the basis of which the search for mechanical and electronic components began. Different components on the market were carefully compared, so that the robot would actually be able to move later and that all the pieces would fit together. It took about a month to select the main mechanical components, i.e. motors and important electronic components (sensors, microcontrollers, battery and others). then, in a few weeks, the first sketches, models of the robot's head and the layout of the components were ready. In terms of space saving and reliability, the author of the production of the product designed the printed circuit boards himself, which initially also took a few weeks. After the design of the printed circuit board was completed, the last finishing touches were made in the design of the mechanics and the body of the robot and other parts were started to be produced. Minor design changes to the mechanics had to be made during assembly, but the overall design of the robot remained the same as it was originally planned. Then the printed circuit board blanks arrived, on which we had to start soldering and testing the components one by one. There were also minor errors towards unconnected connections, but they were easily resolved. When the mechanics and electronics were ready separately, then the integration period began, in which the mechanics and electronics were reconciled and the software development began, the latter of which took the most time. During the development of the software, some small errors in the mechanics and electronics were revealed, such as missing some connections on the circuit board. After solving the biggest problems, the testing period began, where a test track was built for testing the robot and various situations that could occur in competitions were tried out. In the early stages of testing, the robot spent a lot of time stuck by the walls, but as time went on, the robot was able to complete the course better. In the final phase of testing, the robot was already able to navigate the track quite well, the problem areas were wide track sections where turns could occur. Under the conditions, the robot could start to traverse the track backwards. Before that, a gyroscope and its software were added to the robot, but the end of its software implementation was not reached. Finally, the autonomous folkrace robot is ready to drive on its own, but there are areas for improvement in every area.