

## **Abstract**

Over the past couple of years robotics and artificial intelligence have been increasingly gaining popularity. Innovation in technology gives more tools to the experts to work with. The car industry integrates more and more features into their products getting closer and closer to autonomous vehicles. Designing such complex systems poses a lot of challenges to engineers. Real-time signal processing, sensor fusions and control theory are separate fields of expertise on their own, not to mention the automotive requirements. This paper demonstrates the creation of an autonomous car with limited abilities. The car is capable of following a line without prior knowledge about the track. The car implements several functions with redundancy to make it more fault tolerant as a system against problems it might encounter on the track.

This thesis gives a short introduction to the parameters of the RC car used to create the robot car. After this, we go through the control of the car, which gives us an idea about the complexity of the hardware and software we need to design. In the system design we choose the image processing unit (Raspberry PI) and the less powerful controller unit (STM32F4). In following section we go in depth into the steps of hardware design from the power supply unit to the design of the PCB. After this, the paper explains signal processing and control algorithms along with the implementation of diagnostics of the software. The thesis includes the steps and considerations needed to create such a system, furthermore, it validates the model based on test results. The paper discusses the unit part by part as battery management, communication, detection of the distance, respectively compare two line follower solutions, then jump to conclusion. The car has a lot of potential for further improvements, most important of which are the ABS and ASR features as well as the image processing algorithm. These are discussed at the end of the paper along with a summary of my experiences.