1. **Introduction**

The primary goal of the project is to construct a microcontroller-based buggy in which various aspects are crucial and necessary for achieving the desired. The main aim of the buggy is to mainly follow a white line which includes a number of diverse obstacles and challenges. These motivating challenges include, but are not limited to, slopes of maximum 18º, random line gaps of around 6 mm, vulnerability of track to direct sunlight and a tunnel with a 20 cm height. To assist tackling these problems and more, this report delivers the interesting design specifications across the different technical areas required. The aims of this report feed massively into the initial, main target of the entire project and provides the basis for construction and implementation.

The focal purpose of this document is to achieve the essential designs and implementation theories to progress to the next phase of the project. The aims include constructing the software specifications for the buggy to create a better, improved understanding of the system and what will it do exactly. Furthermore, an objective is to choose carefully the ideal line sensor out of the available options. This will be accompanied by the creation and design of the resulting circuit diagrams along with the PCB prototype. Also, focus will be applied on completing a plan that shows and demonstrates the control strategy that will be put in place for execution. The final intention or objective of this report is to generate a practical chassis design which is considered a key hardware component for the overall project.

The mentioned objectives relate closely to the main aims of the whole project in which the buggy creation could not proceed without taking a close look at the relevant sections within this report. To ensure satisfaction of the aims and targets, the report discusses in detail and analyses the following main topics: software, line-sensing, non-line sensing, control theory and hardware overview.

The first section takes a look at the general and specific requirements of the software, which addresses any constraints and the use of any case diagrams to help shape the overall system abilities. This is a requisite for the programming duty as it provides the necessary information to proceed with the coding in the next stage. Following on, the line-sensing part showcases the various possible sensor combinations and includes all required measurements and graphs. This section is responsible for choosing the line sensor which the circuit diagram and PCB design would be based on. Other relevant non-line sensors including encoders will be discussed briefly. Previous sensor choice lays out the foundation for the control section to discuss the proposed sensor set-up along with the most reasonable control algorithm. Finally, all previous sections will provide the components needed to deliver the optimum chassis design along a closer look at the hardware overview.