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| A black background with pink text  Description automatically generated | **Qatar University**  **College of Engineering**  **Department of Computer Science and Engineering** |

Senior Project Report

**Autonomous Golf Cart**

**Project Group Members:**

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**2024**

This project report is submitted to the Department of Computer Science and Engineering of Qatar University in partial fulfillment of the requirements of the Senior Project course.

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|  | Elaborate on algorithmic details of your software components | We added Section 6.4.1, detailing the logic of the emergency\_stop\_node.py, motor\_control\_node.py, and camera\_node. Each node's input/output flow, logic conditions, and interaction with ROS 2 topics are explained. |
|  | Explain how algorithms were validated/verified | Section 7.3.1 was added to describe how each node was tested using ROS CLI tools, topic echoes, and physical observations. Emergency stop and motor logic were verified in real-time scenarios. |
|  | Detail the YOLO algorithm instead of only mentioning it | In Section 6.3 and expanded in Section 10, we included an explanation of YOLOv5, its intended role for object detection, and how it would publish detections. The delay was explained due to hardware limitations. |
|  | Explain "collusion detection" and other AI-related features | Section 10 includes plans for AI-based collision prediction using trajectory estimation from LiDAR and camera inputs. Current ultrasonic logic is described as a placeholder for future predictive models. |
|  | Describe the end-to-end software architecture | Section 5.6 Software Design explains the full architecture from sensor data acquisition through ROS 2 processing to motor control. The modular ROS 2 topic-based pipeline is fully described and diagrammed. |