# ***Report-TORCS***

Members:

Hassaan Anwar 22i-0890

Mishal Ali 22i-1291

Atif Abbasi 22i-1249

## Comparison of Controller Design and Training Approaches

## Introduction

This report compares two different implementations of a driver controller for an autonomous racing simulation. The first approach (Controller New) uses a manually controlled system with keyboard input and real-time logging, while the second approach (Controller Old) follows a more traditional algorithmic approach to steering, gear shifts, and acceleration.

## Overview of Controller Implementation

### Controller New (Manual Input and Logging)

- Uses keyboard inputs (W, A, S, D) for acceleration, braking, and steering.
- Implements manual gear shifting with up/down keys.
- Includes collision detection, adjusting gear upon sudden deceleration.
- Logs sensor data such as speed, track position, opponent distances, and track sensor readings.
- Implements a simple logic for acceleration and braking based on speed and gear ratios.
- Uses real-time human intervention for dynamic decision-making.

### Controller Old (Algorithmic Decision Making)

- Uses a predefined steering function to adjust based on track position and angle.
- Implements an automated gear-shifting mechanism based on RPM values.
- Controls acceleration based on a maximum speed threshold.
- Implements a structured, rule-based approach to drive the car without direct human intervention.

## Comparison Old controller and new controller

| Feature | Controller New | Controller Old |
|---|---|---|
| **Steering Control** | Manually controlled using keyboard | Automated calculation based on track position and angle |
| **Gear Shifting** | Manual override using keys | Automatic shifting based on RPM values |
| **Acceleration** | Controlled via keyboard, manual adjustments | Dynamically adjusted based on speed thresholds |
| **Collision Handling** | Detects sudden deceleration and resets gear | No explicit collision handling implemented |
| **Logging** | Logs extensive data including track sensors and opponents | No logging implemented |
| **Automation Level** | Low, requires human intervention | High, fully autonomous |

## Chosen Design and Training Approach

Based on the analysis, Controller New is chosen for designing and training the controller due to the following reasons:

1. **Data Collection for Machine Learning:**
    - The extensive logging mechanism in Controller New provides valuable data for training an autonomous agent in the future.
    - Data such as speed, steering inputs, opponent proximity, and track sensors allow for reinforcement learning applications.
2. **Flexibility and Adaptability:**
    - Manual control allows for fine-tuning of parameters such as acceleration, braking, and gear shifting.
    - Logging provides insights into driving behavior, allowing iterative improvements.
3. **Improved Collision Handling:**
    - Controller New  actively detects sudden drops in speed and resets the gear accordingly, which helps prevent getting stuck after a crash.