



PROBLEM STATEMENT

In competitive racing environments, such as the **SAE Formula competition**, achieving optimal vehicle performance and ensuring driver safety are critical objectives. Traditional manual gear-shifting systems present several challenges:

1. **Slower Response Times:** Manual gear shifting can be slower compared to automated systems, leading to reduced performance during crucial moments on the track.
2. **Increased Physical Strain:** Drivers experience higher physical strain due to repetitive manual shifting, which can lead to fatigue and decreased focus during the race.
3. **Potential for Mechanical Failures:** Manual gear shifting systems are more prone to mechanical failures, which can compromise the reliability and safety of the vehicle.
4. **Reduced Driver Focus:** The need to manually shift gears diverts the driver's attention from other critical tasks, such as navigating the track and responding to changing race conditions.

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To address these challenges, our team identified the need for an advanced gear-shifting system with the following objectives:

1. **Enhanced Shifting Speed:** Develop a system that allows for faster gear changes, reducing lap times and improving overall vehicle performance.
2. **Improved Accuracy:** Ensure precise gear shifts to maintain optimal engine performance and prevent mechanical issues.
3. **Increased Reliability:** Design a robust system that minimizes the risk of mechanical failures, enhancing the vehicle's reliability during races.
4. **Reduced Driver Strain:** Implement a solution that reduces the physical demands on the driver, allowing for better focus and endurance.
5. **Seamless Integration:** Integrate the new system with existing vehicle electronics to provide real-time feedback and comprehensive safety monitoring.

This led to the development of a Pneumatic Gear Shifter, which aims to overcome the limitations of manual gear shifting and contribute to improved vehicle performance, driver comfort, and overall race safety.

