Title of the Project: **FPGA-Based Digital Speedometer for Precise Vehicle Speed Measurement and Alert**

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Abstract:

The proposed FPGA-based digital speedometer ensures precise vehicle speed measurement. A Hall effect sensor detects wheel rotation via magnetic field changes, generating square wave pulses proportional to speed. A Xilinx FPGA board processes these pulses using Verilog HDL with structural, behavioral, and dataflow modeling for real-time computation. Vivado synthesizes the design, optimizing FPGA resources, while ModelSim validates functionality. Speed is shown on a seven-segment display, with an LED alerting drivers above 80 km/h. The system prioritizes low power, scalability, and reliable performance, enhancing road safety and showcasing proficiency in HDL modeling, simulation, and synthesis.

Objectives of the Work:

- Develop an FPGA-based digital speedometer for accurate vehicle speed monitoring.
- Employ a Hall effect sensor to detect magnetic field changes for precise wheel speed measurement.
- Implement Verilog HDL for efficient design, simulation, and synthesis.
- Display real-time speed on a seven-segment display and trigger a red LED for speeds exceeding 80 km/h.
- Optimize power consumption and FPGA resource usage for efficient, scalable performance.
- Ensure adaptability to diverse vehicle types, enhancing road safety and regulatory compliance.

Tools Used:

- Xilinx Vivado Vivado Design Suite
- Modelism Quartus Prime 20.1
- FPGA Board

Deliverables :

- Functional FPGA-Based Digital Speedometer Prototype: A fully operational system interfaced with a Hall effect sensor for real-time vehicle speed monitoring.
- Verilog HDL Codebase: Complete code implementing structural, behavioral, and dataflow modeling for speed detection, processing, and display logic.
- RTL Schematics: Diagrams generated via Vivado illustrating the system’s architecture, including sensor interfacing and display modules.
- ModelSim Simulation Results: Waveforms validating system performance for speeds below and above 80 km/h, ensuring accurate functionality.

- Hardware Demonstration: Real-time speed display on a seven-segment display with LED alerts for speeds exceeding 80km/h.
- Comprehensive Documentation: Report detailing design methodology, simulation results, and performance comparison with existing speedometer systems.