FPGA-Based Bidirectional Motor Control System Using Verilog

1. Project Overview

   This project demonstrates a bidirectional motor control system implemented using Verilog HDL and deployed on an FPGA platform.
   The system controls the direction of a DC motor - upward or downward - based on two input signals.
   An H-bridge motor driver is used to control the motor, with the logic signals generated by the FPGA.

2. Objectives

   Design a Verilog-based system for motor direction control.
   Simulate the design using standard tools and verify its correctness.
   Implement the system on an FPGA development board.
   Test and validate the control logic with real hardware.
   Document the process and share the results through GitHub and a video demonstration.

3. System Design Functional Description:

   Functional Description:
   - up = 1, down = 0 -> Upward rotation
   - up = 0, down = 1 -> Downward rotation
   - Other cases -> Stop motor

4. Verilog Code:

```
module motor_control ( input clk, input up, input down, output reg
motor_a, output reg motor_b );
always @(posedge clk)
begin
if (up && !down)
begin
motor_a <= 1;
motor_b <= 0;
end
```

```
else if (!up && down)
begin
motor_a <= 0;
 motor_b <= 1;
 end
 else
begin
motor_a <= 0;
motor_b <= 0;
end
end endmodule
```

5. Simulation and Testing :
   Testbench (motor_control_tb.v) simulates all motor states.
   Simulation verified successful transitions and output responses.

6. Hardware Implementation Components:
- FPGA Board
- L293D Motor Driver
- DC Motor
–Push buttons
- Power supply

7. Documentation and GitHub
Repository includes code, simulation results, block diagrams, and demo video.

8. Demonstration Video
Link: https://drive.google.com/file/d/1ee1qVZeI05E1HBLh7g3xq01-Ux764oo5/view?usp=drivesdk
Demo shows motor control using push buttons connected to FPGA.

9. Deliverables Summary
- Verilog Code
- Simulation

- Hardware Test
- GitHub Documentation
- Demo Video

10. Conclusion :
A simple and effective demonstration of motor control using Verilog and FPGA, applicable in automation and embedded systems.
Link:
https://drive.google.com/file/d/1ee1qVZeI05E1HBLh7g3xq01-Ux764oo5/view?usp=drivesdk