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Synopsis

Quiz buzzers are a common tool in educational settings for game shows and live quiz competitions, including those broadcasted on television. They are designed to let participants quickly signal their readiness to answer a question. When activated, a quiz buzzer emits a sound or alarm for a brief period, with a minimal reaction time. Beyond competitions, buzzers have various uses, such as in annunciator panels, electronic metronomes, microwave ovens, and other household appliances.

Traditional quiz systems often rely on human judgment to determine which team pressed their buzzer first. This method can be prone to error and potential bias, especially when participants press their buzzers nearly simultaneously, making it challenging to ascertain the order. To address these issues, we have developed an automated quiz buzzer system that accurately accounts for the timing of multiple buzzer activations and displays the sequence. Utilizing an encoder, the system scans inputs from the push buttons and indicates the corresponding team number on a seven-segment digital display. This straightforward circuit is designed for simplicity, avoiding unnecessary complexity, and ensures precise timing recognition. While the current model supports up to eight teams, the system can be expanded to accommodate additional teams by incorporating more sets of eight push buttons.

In a quiz competition with eight teams, when a team presses their buzzer, they should be given priority, and their team's buzzer should be highlighted. To accurately determine the sequence in which the buzzers are pressed, the system utilizes logic circuitry that includes D flip-flops, NAND gates, and inverters. This circuitry calculates the time delay between the activation of each team's buzzer.

When a buzzer is pressed, the D flip-flop captures the state, ensuring that even if two teams press their buzzers at almost the same time, the system can discern the order of activation. The NAND gates function as part of the logic that processes these inputs, while inverters are used to maintain the correct logic levels. The combined output from this circuitry is then sent as an input signal to the NAND gate associated with each individual team.

This process ensures that the first team to press their buzzer is given priority, and their action is immediately displayed, allowing for a fair and unbiased recognition of quick responses during the competition.

Introduction

The goal of this project is to design a detector system that can identify a specific team's quiz buzzer in a quiz competition. The system will scan the input from multiple push buttons and display the corresponding team number on a BCD Seven segment display device. This is a practical application of VLSI design, which involves creating complex digital circuits using millions of transistors on a single silicon chip.

VLSI design is crucial for this problem because it allows us to build a compact, high-speed detector system. Traditional methods of connecting separate buzzers to a controller would be bulky and slow. By integrating the detectors and processing logic into a single chip, we can achieve a much more efficient and versatile solution.

The detector system will need to handle the following key aspects:

***Buzzer Input Scanning*:** The system must rapidly scan the input from multiple push buttons (buzzers) to determine which team pressed their buzzer.
Team Number Assignment: Each team must have a unique number assigned to their buzzer. This number will be displayed on the output device when their buzzer is pressed. This is achieved by using encoders.
***Display Control*:** The system must control the output on the seven segment display to show the correct team number.

The project involves digital logic design, timing analysis, and analog interface circuitry. The use of Cadence software allows for simulating the design and verifying its functionality.

Literature Review

Title	Author	Journal	Year	Summary
An 8-Channel Quiz Buzzer System Is Implemented Using Arduino	Maarjani Sanghavi, Rajiv Sadriwala	ecc.journalspub	2021	With the help of a few digit displaying devices and a programmable open-source microcontroller board, this study attempts to construct and implement a low-cost and dependable quiz buzzer system that will make it simpler to identify contestants or participants during a live television show or school quiz.
A Design of Low Power and High Speed Encoder and Decoder Circuits by Re-Evaluating High Speed Design Values	Abin Satheesan, S Geethiga	IEEE	2019	These days, the main focus in research is on the fast advancement of CMOS technology, which reduces power and area while increasing chip speed. This paper's encoders and decoders are developed with the suggested TGL in mind, which helps to reduce trade-off issues to a large degree.
Low Power CMOS Counter Using Clock Gated Flip-Flop	U. Kaur, R. Mehra	Semantic Scholar	2013	Clock gating reduces redundant clock activity inside the gated module, allowing for power savings. In this study, a new counter utilizing a clock-gated flip-flop is described. The circuit uses a novel clock gating flip flop technique to lower the power consumption of the signal during switching. There are now fewer transistors in the system.

Design Methodology and Implementation

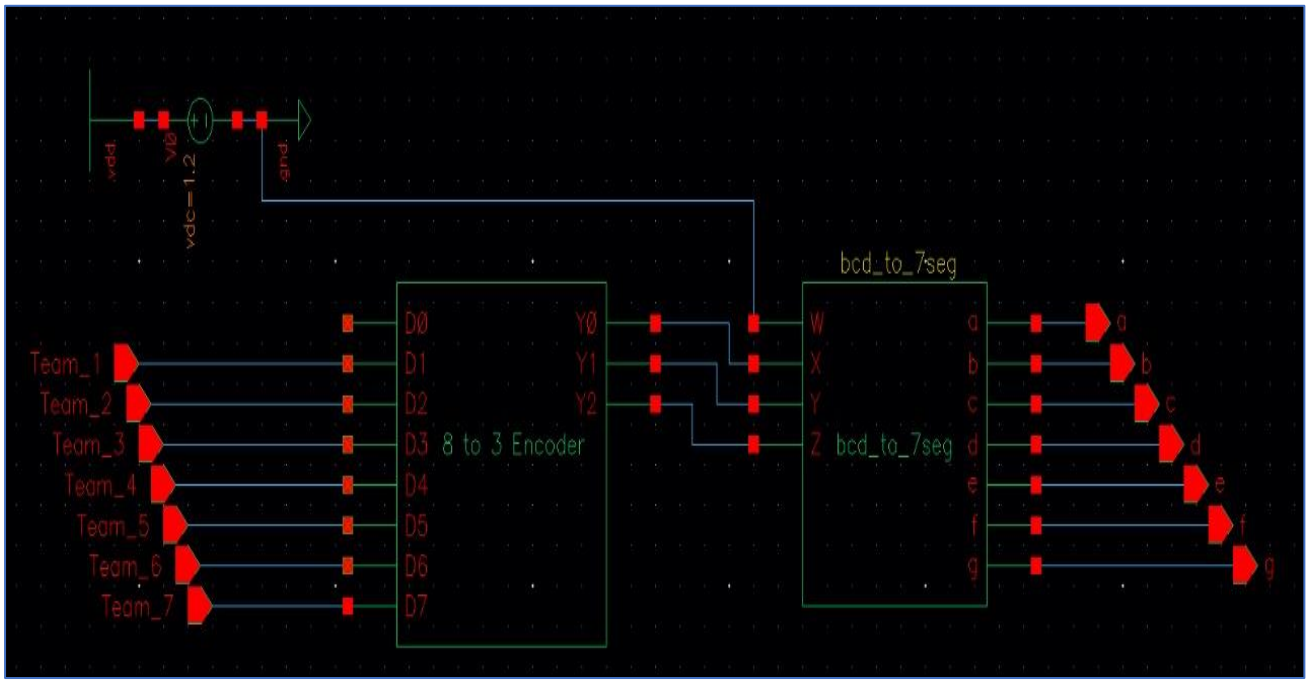

Figure 1: 8:3 Encoder and BCD to 7 segment decoder

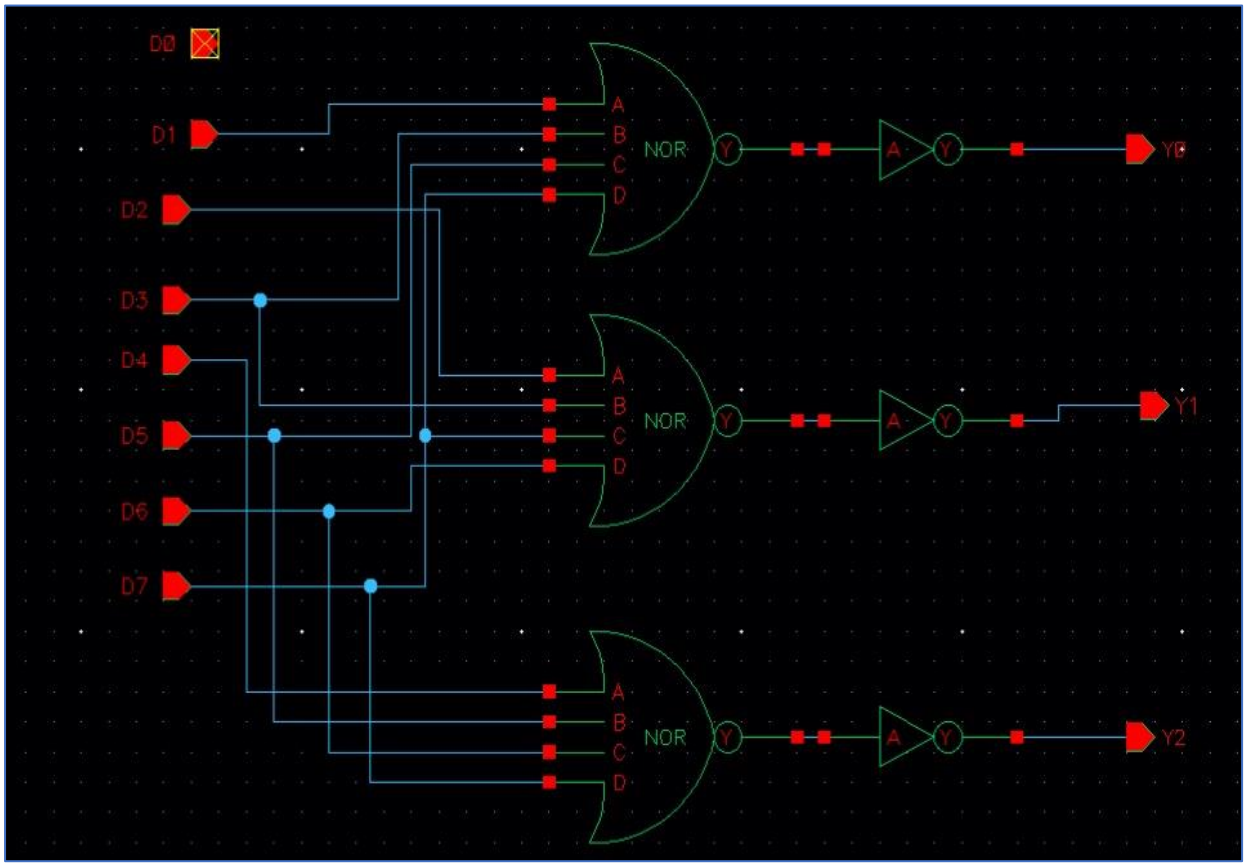

Figure 2: The Circuit (schematic) for encoder

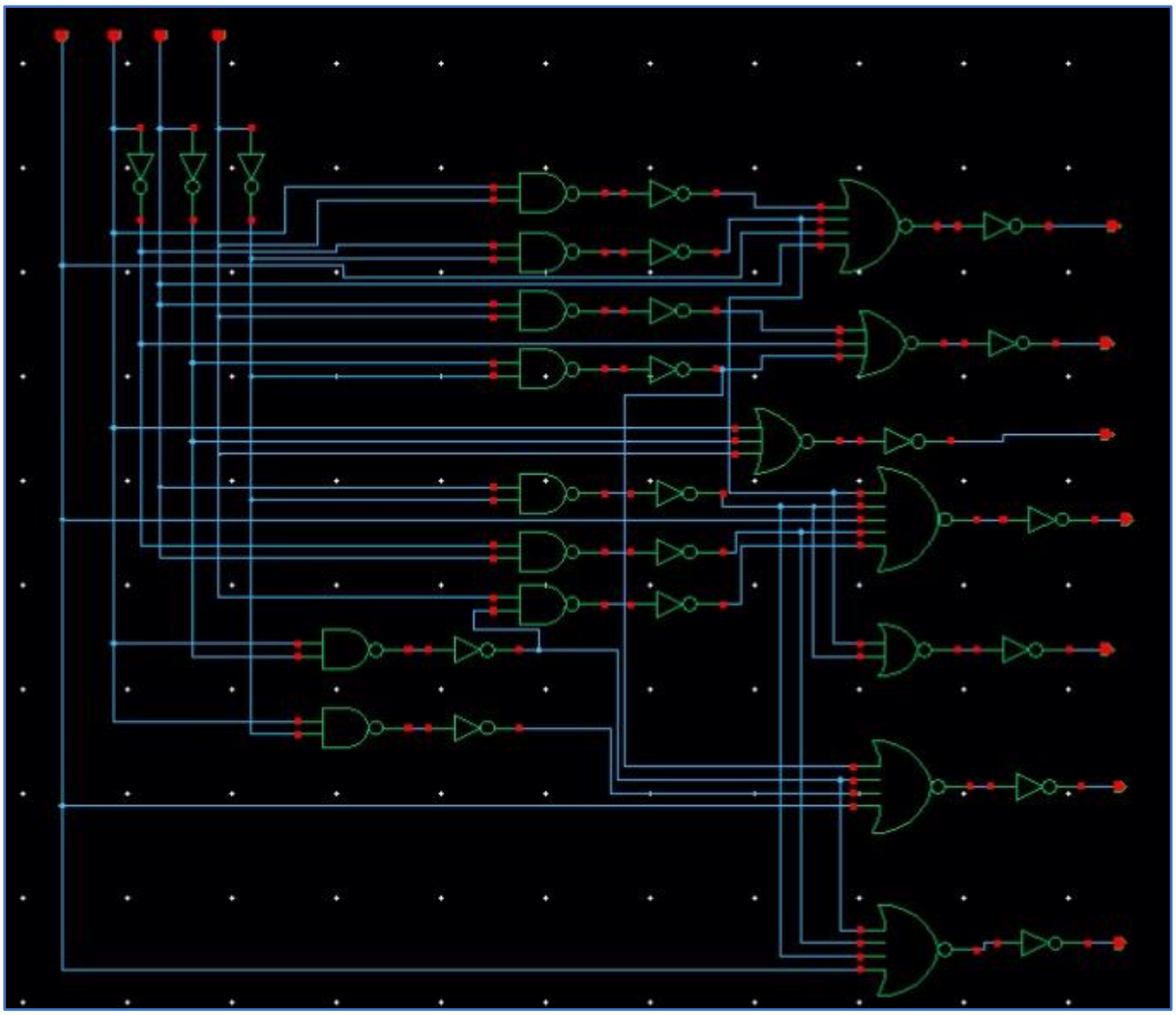

Figure 3: Schematic of Seven Segment Decoder

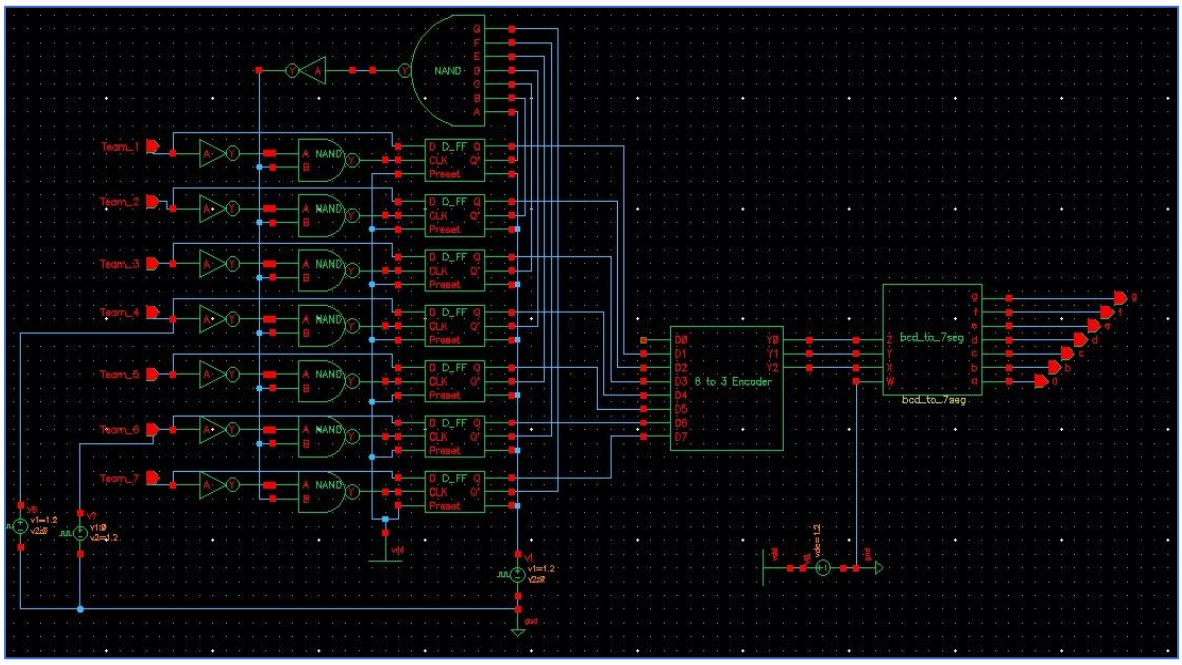

Figure 4: Schematic of Quiz Buzzer

Results and Discussions

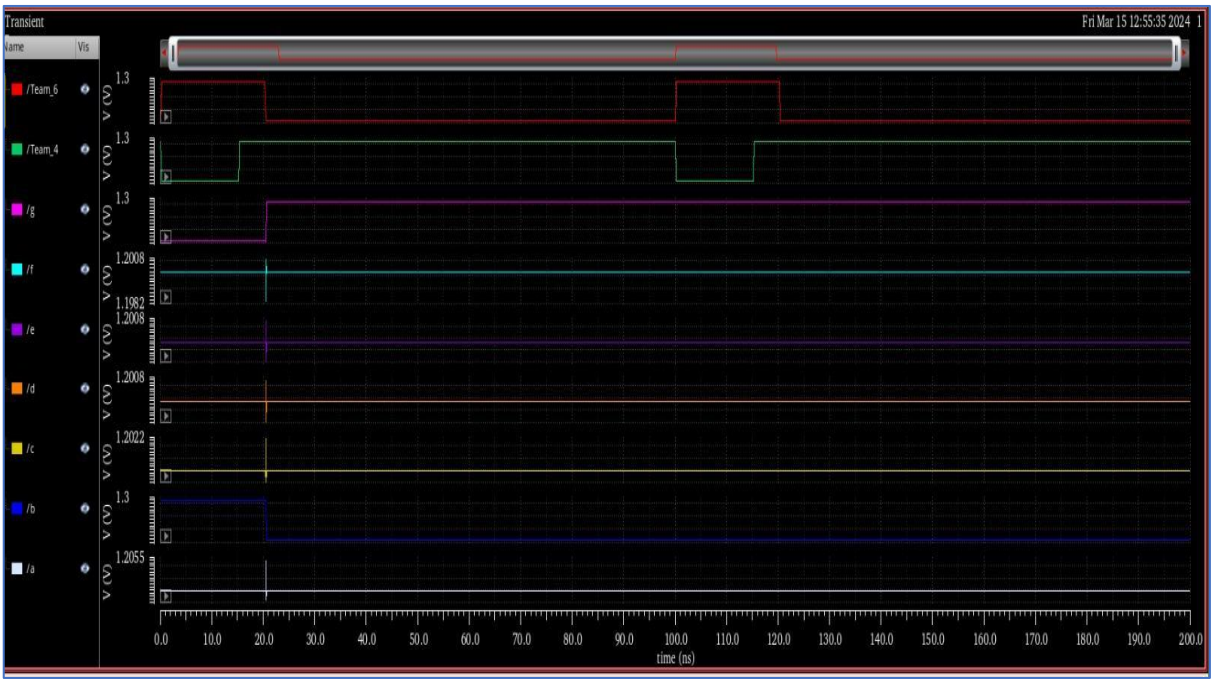

Figure 5: Output Timing Diagram

Here, the inputs of team 4 and 6 are given high, which signals that these two teams have pressed the buzzer. Using the circuitry for determining the delays, it is observed that Team 6 pressed the buzzer first, so they received priority. Therefore, the BCD Seven segment display should show ‘6’. Since the BCD display is active low, all the segments (a, c, d, e, f, g) are low and ‘b’ is high so six is displayed. In this manner, the circuit displayed above acts as a quiz buzzer.

Learning Outcomes

1. Literature Review and research helped in understanding existing systems to gain a comprehensive understanding of conventional quiz buzzer systems, noting their limitations and areas where human error or bias can occur.

2. Technological Evolution - Learn about the evolution of quiz buzzer systems, from simple mechanical or electrical circuits to sophisticated microcontroller-based systems.

3. Insight into Logic Circuits - Acquire knowledge on how various logic circuits like D flip-flops, NAND gates, and inverters are used in real-world applications, particularly in timing and control systems.

4. Enhance skills in designing digital circuits using simulation software such as Cadence, which provides a virtual environment to test and refine circuit designs before physical prototyping.

5. Develop problem-solving skills by troubleshooting issues that arise during simulation, such as timing conflicts or logic errors.

6. Learn to interpret simulation results, understanding how the timing and logic of the circuit operate under different conditions.