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Digital Quiz Buzzer System Using Microcontroller

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Abstract: ***A Digital Quiz Buzzer System with Microcontroller Control is designed to ensure fairness, speed, and accuracy in quiz competitions. Traditional systems often fail to detect the first responder correctly when multiple participants press buttons simultaneously. This system uses an Arduino Nano microcontroller to detect and lock the first input among multiple users. The system provides real-time response detection, activates a buzzer alert, and displays results on LCD screens. The developed system ensures accurate, reliable, and fast operation, improving fairness and reducing human error in quiz competitions.***
Keywords: Microcontroller, Arduino Nano, Buzzer System, First Response Detection, I2C Display, Quiz System

I. INTRODUCTION

Quiz competitions are widely used in schools, colleges, and events to promote knowledge and quick thinking. In such competitions, identifying the fastest participant is important to maintain fairness. Traditional buzzer systems, which use simple electrical circuits, often fail to clearly detect the first response when multiple buttons are pressed at the same time, leading to confusion and errors.

To solve this problem, a microcontroller-based digital quiz buzzer system is developed. The system uses an Arduino Nano to monitor multiple inputs, identify the first button pressed, and automatically disable the remaining inputs. It also provides output through a buzzer and LCD display for clear indication.

The proposed system ensures accurate and fast response detection while reducing human error. It is cost-effective, easy to operate, and can be expanded for more participants. This makes it suitable for use in educational institutions and competitive quiz events.

II. LITERATURE REVIEW

Traditional quiz buzzer systems were based on simple circuits using switches, buzzers, and indicator lights. These systems depended on human observation to identify the first responder, which often led to confusion and errors when multiple participants pressed buttons simultaneously.

To overcome these limitations, researchers developed microcontroller-based quiz buzzer systems. These systems provide features such as fast response detection, automatic input locking, and quick reset, ensuring accuracy and fairness. Microcontrollers process signals within microseconds, allowing precise identification of the first response.

Among various controllers, Arduino Nano is widely used due to its compact size, low cost, and easy programming. It enables efficient implementation of automated and reliable quiz buzzer systems.

III. METHODOLOGY

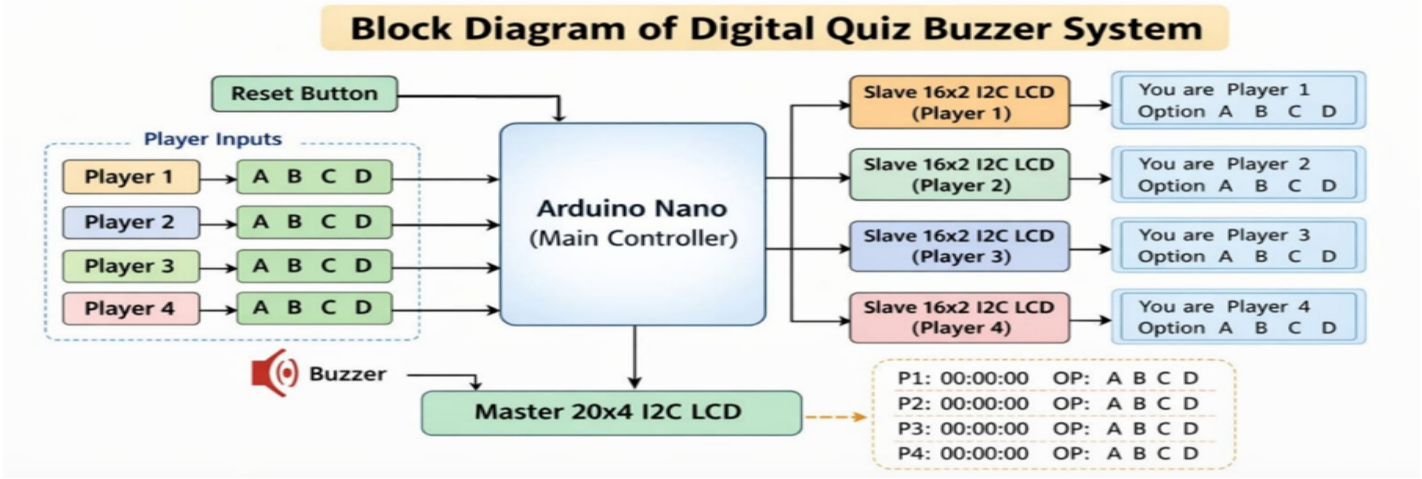

Fig 1. Block Diagram of Digital Quiz Buzzer System with Microcontroller.

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The methodology of the Digital Quiz Buzzer System with Microcontroller Control explains the step-by-step working process of the system based on the block diagram. The system is mainly controlled by the Arduino Nano, which receives signals from player buttons and controls the buzzer and LCD displays.

Step 1: System Initialization

When the system is powered on, the Arduino Nano initializes all connected components such as push buttons, LCD displays, and the buzzer. The displays show the initial message indicating that the system is ready for operation.

Step 2: Reset Button Activation

The quiz master presses the reset button before starting a new round. This clears all previous responses stored in the system and prepares it to accept new inputs from the players.

Step 3: Player Input Setup

There are four players in the system: Player 1, Player 2, Player 3, and Player 4. Each player has four push buttons representing answer options A, B, C, and D. These buttons are connected to the input pins of the Arduino Nano.

Step 4: Question Asked

The quiz master asks a question to all participants. At this stage, the system waits for any player to press one of the option buttons.

Step 5: Player Presses an Option

When a player presses one of the buttons (A/B/C/D), a signal is sent to the Arduino Nano. The microcontroller continuously monitors all player inputs to detect the first response.

Step 6: First Player Detection

The Arduino Nano identifies which player pressed the button first. Once the first input is detected, the system locks the other player inputs to maintain fairness during the quiz.

Step 7: Buzzer Activation

After detecting the first response, the system activates the buzzer. The buzzer produces a sound to indicate that a player has answered first.

Step 8: Record Player and Option

The microcontroller records the player number and selected option in its memory. This information is then prepared to be displayed on the LCD screens.

Step 9: Update Player LCD Displays

Each player has a 16×2 I2C LCD display that shows messages such as the player number and the selected option (A, B, C, or D).

Step 10: Update Master LCD Display

A 20×4 I2C LCD display acts as the master display. It shows information for all players, including player number, response time, and the selected option.

Step 11: End of Round

After displaying the result, the system waits for the quiz master to press the reset button again to start the next quiz question

IV. MODELING AND ANALYSIS

The Digital Quiz Buzzer System is designed by combining both hardware and software modeling to ensure fast and accurate response detection. The main controller used in this system is the Arduino Nano, which manages all inputs from the players and controls the outputs such as displays and buzzer.

A. System Modelling

In the system model, four players are connected to the microcontroller through push buttons representing options A, B, C, and D. Each button acts as an input signal. When a player presses any option button, the signal is sent to the microcontroller for processing. The microcontroller continuously monitors all input signals and determines which player pressed the button first.

Each player also has a 16×2 I2C LCD display that shows player identification and answer options. In addition, a 20×4 I2C LCD display is used as the master display to show the overall quiz information such as player number, response time, and selected option.

B. System Analysis

The system analysis focuses on how efficiently the microcontroller processes the input signals. When the quiz begins, all player inputs are active. As soon as a player presses a button, the microcontroller detects the signal within milliseconds and immediately locks the other inputs. This prevents multiple responses and ensures fairness in the quiz competition.

A buzzer is activated when the first response is detected, giving an audible indication that a player has answered. The selected player and option are then displayed on the master display for the quiz master to verify.

Performance Analysis

The system provides several advantages in terms of performance:

- Fast response detection due to microcontroller processing
- Accurate identification of the first player
- Reduced human error in quiz competitions
- Clear information display for both players and the quiz master

V. RESULTS AND DISCUSSION

The Digital Quiz Buzzer System was successfully designed and implemented using a microcontroller-based approach. The main controller used in the system is the Arduino Nano, which manages all inputs from the players and controls the output displays and buzzer.

A. Results

After assembling the hardware components and uploading the program to the microcontroller, the system was tested with four players. Each player was provided with four push buttons representing options A, B, C, and D. Individual 16×2 LCD displays were used for players, and a 20×4 LCD display was used as the master display.

During testing, the system successfully detected the first player who pressed a button. The microcontroller immediately locked all other inputs, ensuring that only the first response was accepted. The selected player number and option were clearly displayed on the master LCD screen. At the same time, the buzzer produced a sound to indicate that a valid response had been received.

The reset button also worked properly by clearing the previous result and preparing the system for the next question. The I2C communication allowed multiple LCD displays to work efficiently with fewer connecting wires.

B. Discussion

The results show that the digital quiz buzzer system provides fast and accurate response detection. The use of a microcontroller improves reliability and reduces manual errors during quiz competitions. The system is also easy to operate and can handle multiple players simultaneously.

The display system makes the results clear for both players and the quiz master. The buzzer sound adds an additional alert to indicate the first response. Overall, the system performs effectively and demonstrates that a microcontroller-based design is a suitable solution for managing quiz competitions in schools, colleges, and other events.

VI. CONCLUSION

The Digital Quiz Buzzer System with Microcontroller Control was successfully designed and implemented to improve the efficiency and fairness of quiz competitions. The system uses the Arduino Nano as the main controller to manage inputs from multiple players and to control the display and buzzer outputs. The developed system is capable of detecting the first player who presses the buzzer and automatically blocking the other inputs. This ensures accurate and fair response selection during quiz competitions. The use of individual player displays and a master display helps both participants and the quiz master clearly view the responses and options.

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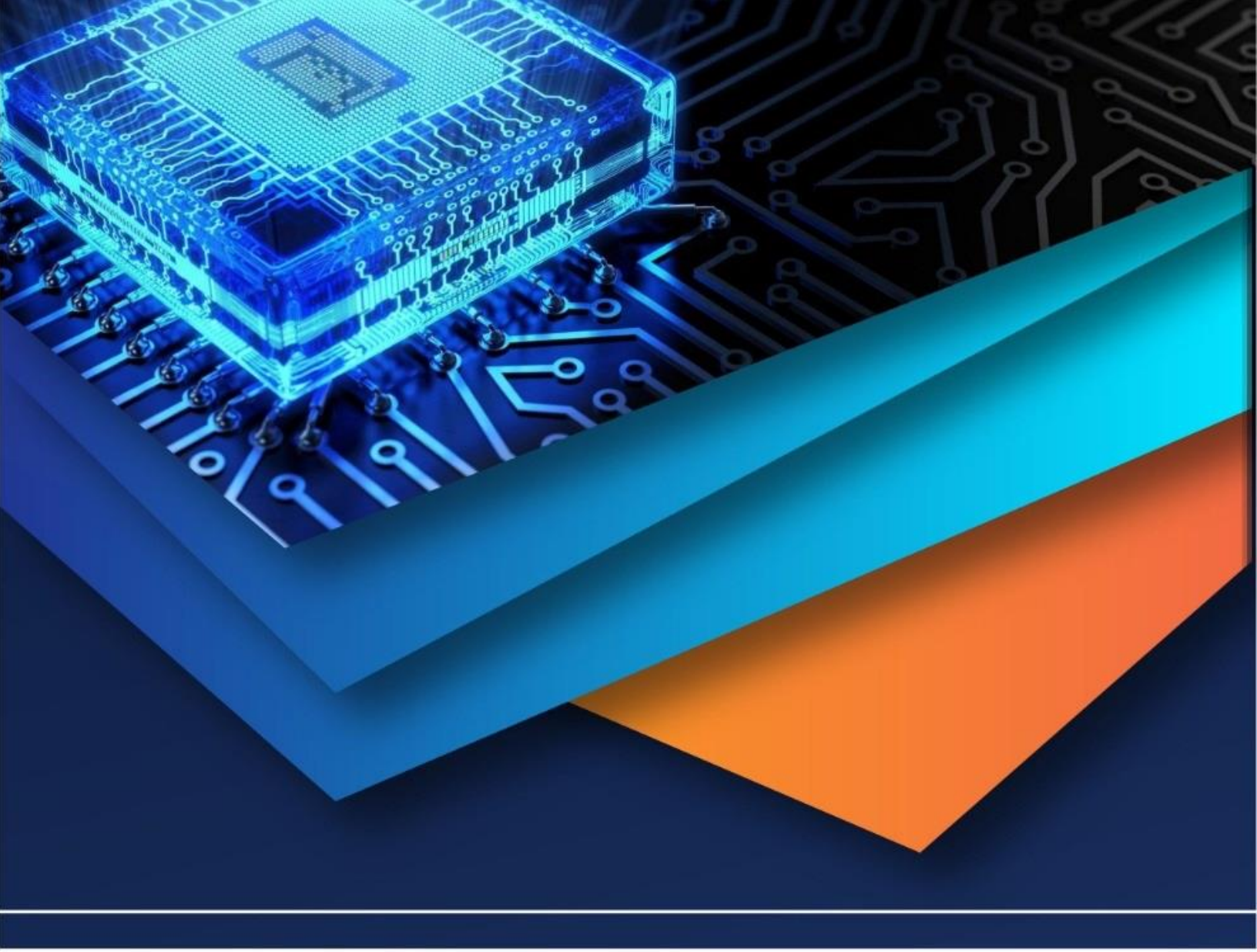

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