Test Course Project

X-O Game

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1.Introduction

X-O game, also known as Tic-Tac-Toe, is a simple two-player game played on a 3x3 grid. The game is won by the player who successfully places three of their symbols (either X or O) in a horizontal, vertical, or diagonal row.

The game was interfaced with a Tiva C microcontroller and a Nokia5110 screen, along with 5 switches for player input. The Tiva C microcontroller, also known as the TM4C123GH6PM, is a low-power, high-performance microcontroller that is widely used in embedded systems.

 The microcontroller can be programmed using C language to handle the game logic and interface with the Nokia5110 screen and switches. The Nokia5110 screen is a popular LCD screen that is easy to interface with microcontrollers and can display text and graphics.

The game can be played by two players taking turns to place their symbol on the grid using the switches. The microcontroller can read the switch input and update the grid on the Nokia5110 screen accordingly. The microcontroller can also check for a win or tie condition and display the result on the screen.

2.Hardware components

- TIVA C Launchpad
- Nokia 5110 Screen
- Push Buttons
- LEDS
- Buzzer
- Jumpers

3.Configuration

Nokia 5110 Screen

1. PIN1 (RST) connected to PA7
2. PIN2 (CE) connected to   PA3
3. PIN3 (DC) connected to   PA6
4. PIN4 (Din) connected to   PA5
5. PIN5 (Clk) connected to   PA2
6. PIN 6 (Vcc) power 3.3V
7. PIN 7(BL) not connected.
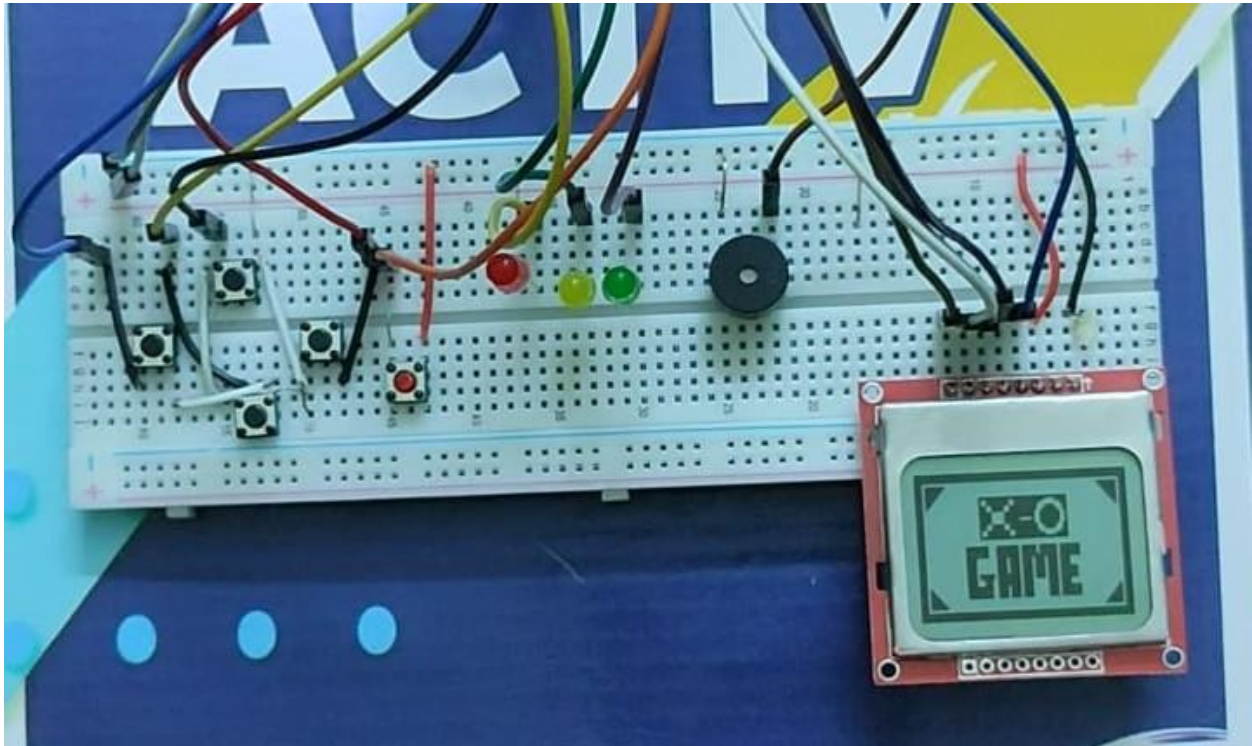8. PIN 8(GND) ground.

Push Buttons

1. Button (Right) connected to PF4
2. Button (Left) connected to   PF3
3. Button (Up) connected to   PF2
4. Button (Down) connected to PF1
5. Button (Play) connected to   PF0

LEDS

1. LED (X-Player) connected to PB2
2. LED (O-Player) connected to PB3
3. LED (Alarm) connected to   PB4

4.Game Interface

Opening of game

The game interface for the X-O game implemented with C programming language and interfaced with Tiva C and Nokia5110 screen can be simple and intuitive. The Nokia5110 screen can be used to display the 3x3 grid for the game and the current player's turn. The screen can also display the game result when the game is over.

The interface can be designed to allow players to use 5 switches to control the game. Four switches can be used to move the cursor on the grid to select the position for the player's symbol (Right, Left, Up, Down). Another switch can be used to place the symbol in the selected position.

The interface can also include sound effects and LED indicators to provide feedback to the players. For example, Green LED represent that the X-player who is the current player, orange LED represent that O-player who is the current player, red LED represent that the player select cell it is already busy with symbol and a beep sound can be played when a player places their symbol on a busy grid.

The game also interferes with UART communication protocol which enable the player to play from laptop without using switches.
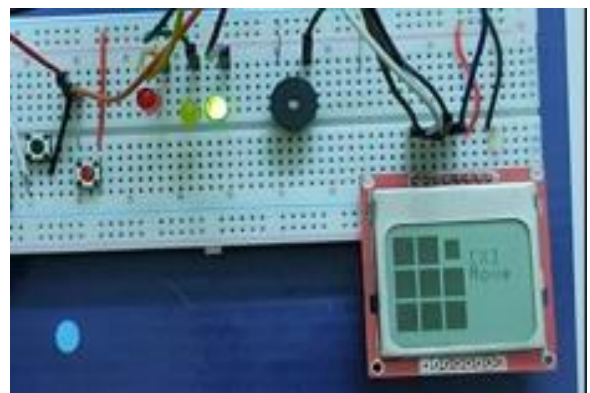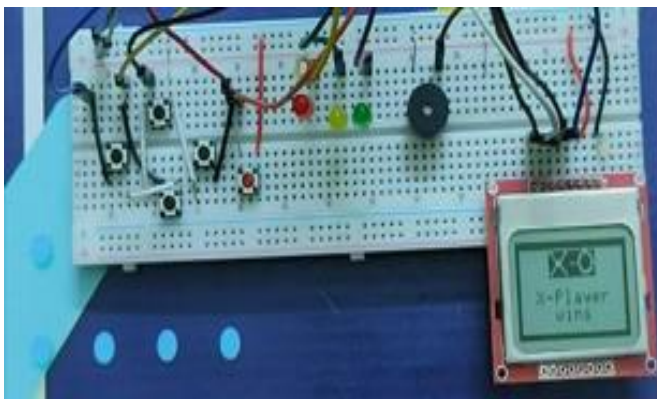
5.Game Implementation

The X-O game implementation utilizes various features of the microcontroller, such as interrupts, timers, UART, and GPIO.

Implementing the X-O game using GPIO driver can be a straightforward and efficient way to handle player input and update the game state. The GPIO driver provides an interface for reading and writing to the microcontroller's GPIO pins, which can be used to detect switch input from the players and update the game state accordingly. Also, GPIO driver support many API's Such as setPinDirection, setPinValue, EnableIntrrupt, SelectInterruptEvent, etc. The GPIO driver can be used to detect switch input and trigger an interrupt service routine (ISR) to handle the input.

Implementation of the X-O game using NVIC (Nested Vectored Interrupt Controller) driver which can provide a more robust and efficient way to handle player input and update the game state. The NVIC driver provides an interface for managing interrupts and prioritizing interrupt requests, which can be used to handle switch input from the players and update the game state accordingly.

To implement the game using NVIC driver, the microcontroller's GPIO pins can be configured as inputs for the switches and connected to the NVIC inputs. The NVIC driver can be used to detect switch input and trigger an interrupt to handle the input. The interrupt can be prioritized to ensure that the game logic ISR is executed before any other interrupt requests.

Implementation of X-O game using timer which can be used to limit the amount of time a player has to make their move and can automatically switch to the other player's turn if the timer runs out, also using in as timer delay between the frames.

The UART can be used to send game state updates from the computer to a microcontroller. This can be useful for monitoring the game's state.

To implement the game with UART, the microcontroller's UART module can be configured to transmit and receive data using a specified baud rate. The game logic can be programmed to send game state updates and debug information to the UART module, which can then be read by a microcontroller using a terminal program or a custom application.

Implementing the X-O game with LED driver can provide visual feedback to the players and add an extra level of excitement to the game. The LED driver can be used to light up LEDs, turn off and Toggle LEDs to indicate the current player's turn or to provide feedback when a player places their symbol on the grid.