DLD PROJECT PROPOSAL

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PROJECT IDEA A: Main idea

Project Title: Turn Up the Guitar

Description:
The game starts as a grid made up of squares. Each column of the grid will be designated one particular color. For our prototype, we have assigned 4 different colors per column as such:

- Column 1: red
- Column 2: blue
- Column 3: green
- Column 4: yellow

Respectively, 4 buttons of the BASYS-3 device are assigned each color, so when a button is pushed, that button's color shows up on the last row of the grid (let's call this row A) in its respective column. A coloured block appears at the top of the column, and moves sequentially, block by block, down the column, towards row A.

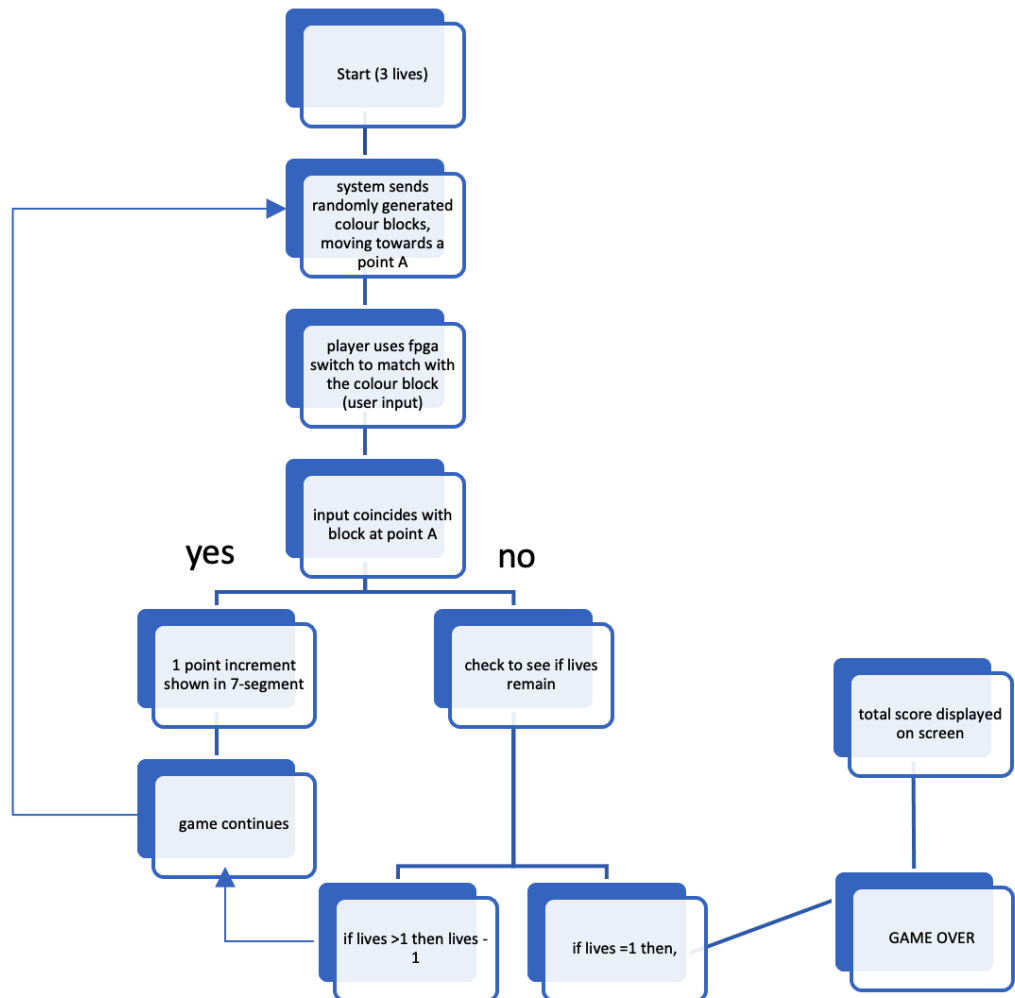The user (you) tries to coincide as many input blocks (with the help of fpga switches) as possible with the system-generated blocks.
If the user succeeds, they gain a point. The score is being counted on the 7-segment display and a certain music plays as the game progresses.
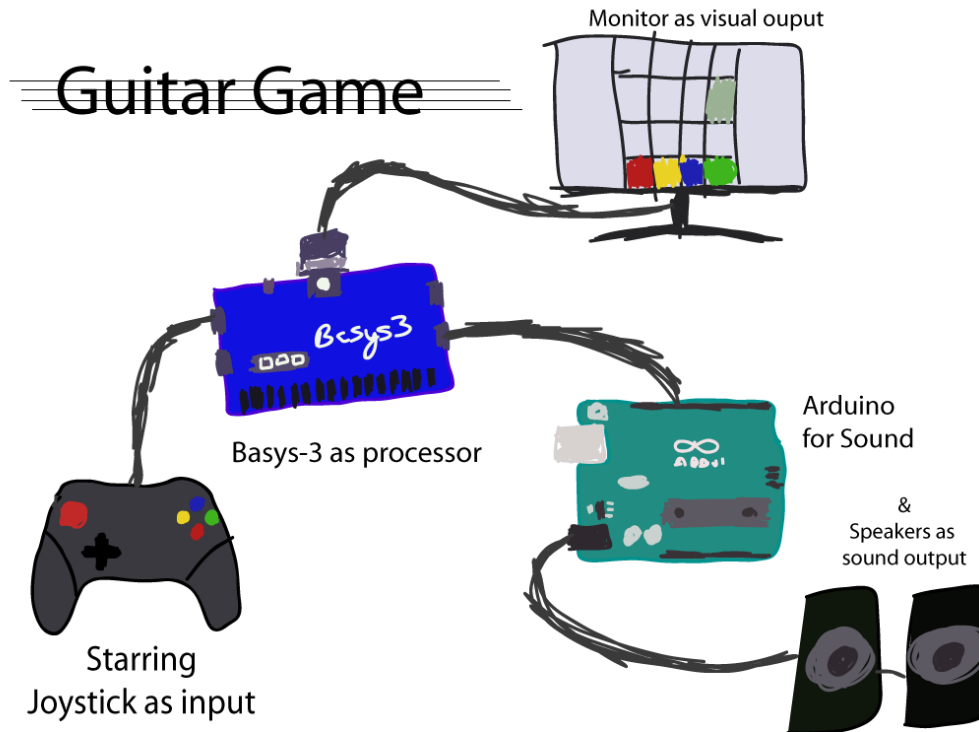(Music implementation is tentative)

If the user misses, he/she loses a life. After six misses, the game ends, and the total score is displayed on the screen.
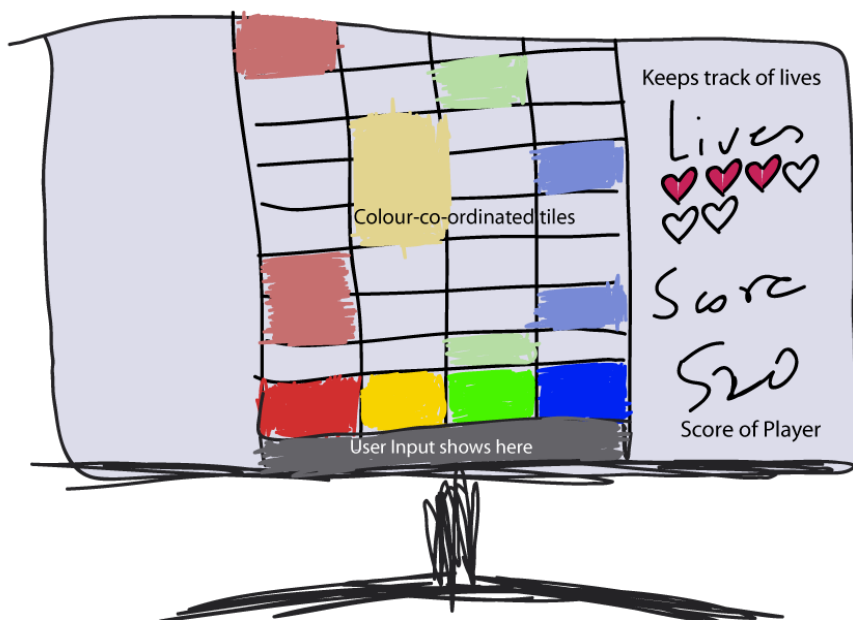
Block diagram:

```
                    ┌──────────────────┐
                    │   Start (3 lives) │
                    └──────────────────┘
                             │
                             ▼
                    ┌──────────────────┐
                    │  system sends    │
     ┌─────────────►│randomly generated│
     │              │  colour blocks,  │
     │              │ moving towards a │
     │              │     point A      │
     │              └──────────────────┘
     │                       │
     │                       ▼
     │              ┌──────────────────┐
     │              │ player uses fpga │
     │              │ switch to match  │
     │              │with the colour   │
     │              │ block (user input)│
     │              └──────────────────┘
     │                       │
     │                       ▼
     │              ┌──────────────────┐
     │         yes  │ input coincides  │  no
     │        ┌─────┤ with block at    ├─────┐
     │        │     │     point A      │     │
     │        │     └──────────────────┘     │
     │        ▼                              ▼
     │  ┌──────────────┐          ┌──────────────────┐
     │  │ 1 point      │          │ check to see if  │
     │  │ increment    │          │  lives remain    │
     │  │ shown in     │          └──────────────────┘
     │  │ 7-segment    │                   │
     │  └──────────────┘           ┌───────┴────────┐
     │        │                    ▼                ▼
     │        ▼           ┌──────────────┐  ┌──────────────┐
     │  ┌──────────────┐  │ if lives >1  │  │ if lives =1  │
     └──┤game continues│◄─┤ then lives-1 │  │   then,      │
        └──────────────┘  └──────────────┘  └──────────────┘
                                                    │
                                          ┌──────────────┐
                                          │  GAME OVER   │
                                          └──────────────┘
                                                 │
                                          ┌──────────────┐
                                          │ total score  │
                                          │ displayed    │
                                          │ on screen    │
                                          └──────────────┘
```

Prototype (what our game will look like):

Hardware:

Monitor as visual ouput

Guitar Game

Basys-3 as processor

Arduino
for Sound

&
Speakers as
sound output

Starring
Joystick as input

On screen:

Keeps track of lives

Lives

Colour-co-ordinated tiles

Score

S20

User Input shows here

Score of Player

Task Division:

- Iqra and Rabia: responsible for the coding aspect of the game and the GUI
- Bismaa and Zoya: Hardware implementation of the game such as using the joystick and Verilog to take the user input

References:

- https://www.youtube.com/shorts/f_4xqWthCdU (the inspiration for the game, however our way of taking the input will be through a controller/joystick)
- https://maker.pro/arduino/projects/arduino-speaker
- https://digilent.com/reference/programmable-logic/basys-3/demos/gpio?redirect=1

PROJECT IDEA B: **Backup idea**

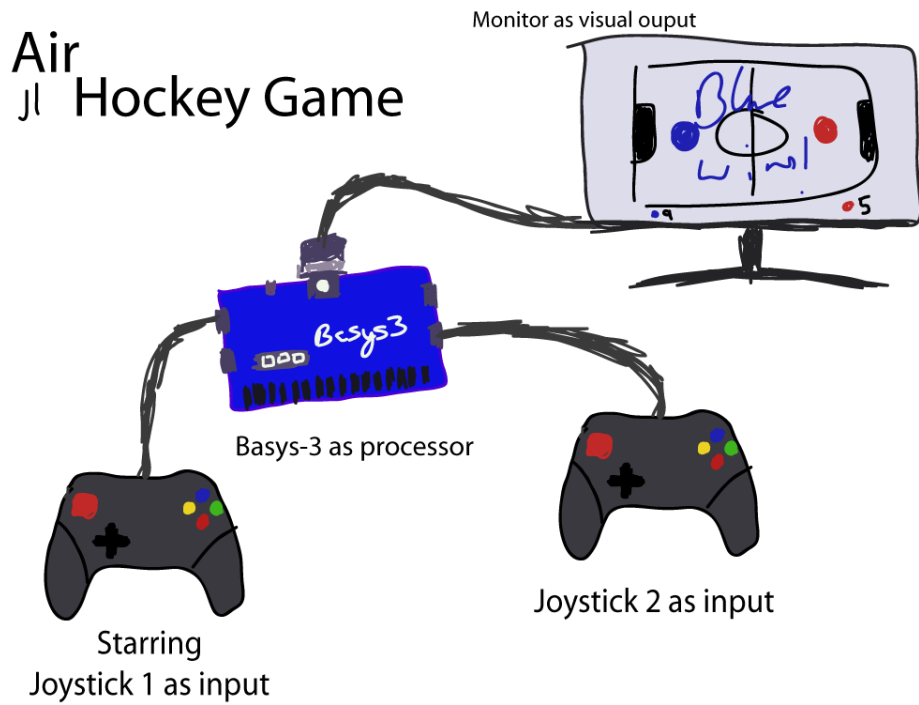**Project Title:** 2-player Air hockey

Description: For this game, we are making a digital/computer version of the Air Hockey game at arcades. Using a joystick controller, we will control the movement of the mallet .

When the game begins, the puck's initial position is the middle of the board, and always goes to player 1. If the puck hits the mallet, it rebounds (like a reflection) and goes in another direction. If a player misses the puck, the puck moves off the screen, the other player gets a point, and the game restarts.

Maximum points per game will be 3. Once any player reaches a score of 3, the game ends and that player is the winner (displayed on the screen).

Prototype:(what our game will look like):

Hardware:

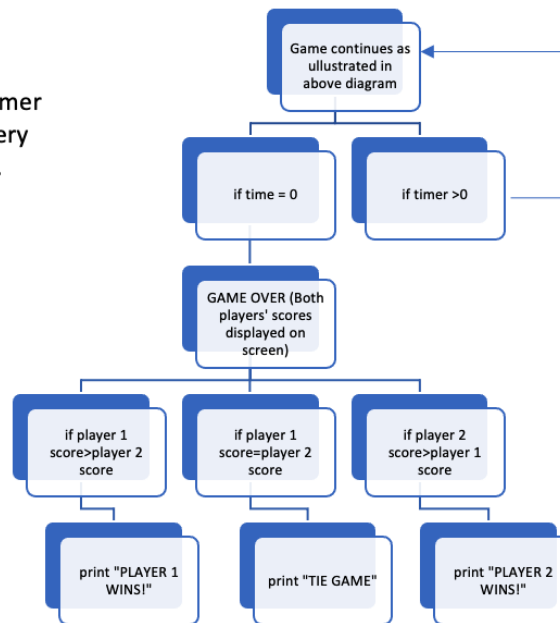Monitor as visual ouput
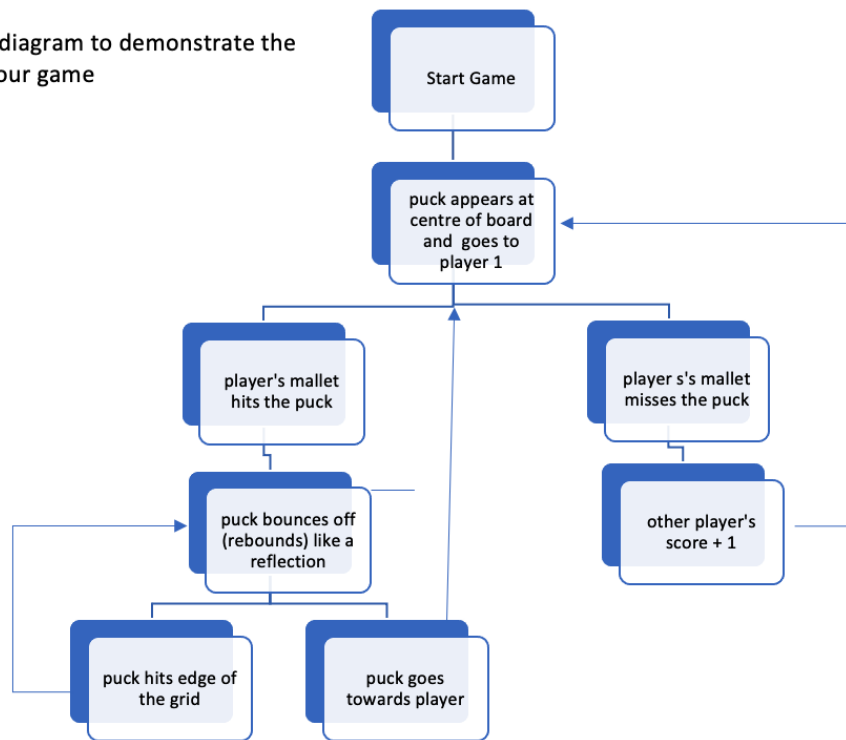
Air
Hockey Game

Besys3

Basys-3 as processor

Starring
Joystick 1 as input

Joystick 2 as input

On screen:

Puck bounces off walls

Blue hits puck

Red tries to save

"Oh No."

Blue AOE

Red AOE
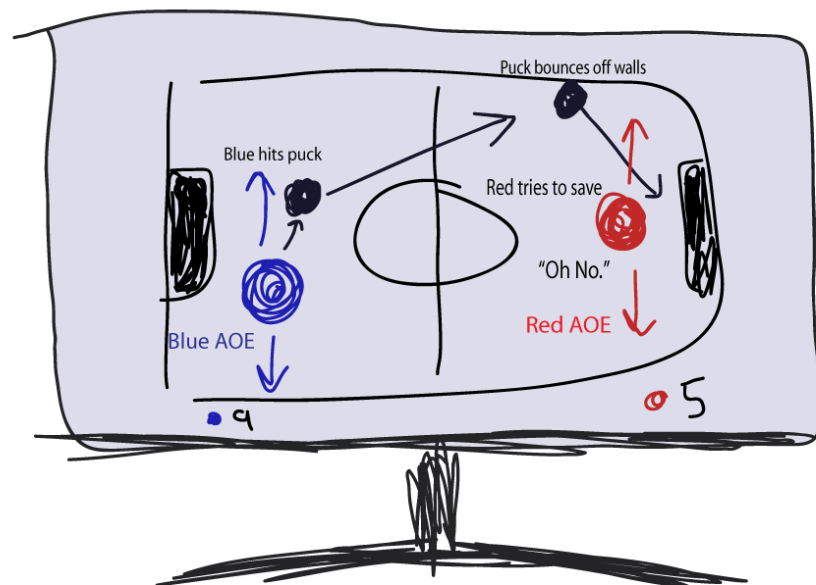
AOE = Area of Effect

Block Diagram:

Block diagram for timer which applies to every instant in the game.

```
                          ┌─────────────────┐
                          │ Game continues as│◄──────────┐
                          │ ullustrated in   │           │
                          │ above diagram    │           │
                          └────────┬─────────┘           │
                     ┌─────────────┴─────────────┐       │
              ┌──────┴──────┐             ┌───────┴─────┐ │
              │ if time = 0 │             │ if timer >0 │─┘
              └──────┬──────┘             └─────────────┘
          ┌──────────┴──────────┐
          │ GAME OVER (Both     │
          │ players' scores     │
          │ displayed on        │
          │ screen)             │
          └──────────┬──────────┘
      ┌──────────────┼──────────────┐
┌─────┴─────┐  ┌─────┴─────┐  ┌─────┴─────┐
│ if player 1│  │ if player 1│  │ if player 2│
│ score>player 2│ score=player 2│ score>player 1│
│ score     │  │ score     │  │ score     │
└─────┬─────┘  └─────┬─────┘  └─────┬─────┘
┌─────┴─────┐  ┌─────┴─────┐  ┌─────┴─────┐
│ print     │  │ print     │  │ print     │
│ "PLAYER 1 │  │ "TIE GAME"│  │ "PLAYER 2 │
│ WINS!"    │  │           │  │ WINS!"    │
└───────────┘  └───────────┘  └───────────┘
```

Main block diagram to demonstrate the working of our game

```
                    ┌─────────────┐
                    │ Start Game  │
                    └──────┬──────┘
                    ┌──────┴──────┐
                    │ puck appears at│◄───────────┐
                    │ centre of board│           │
                    │ and  goes to  │           │
                    │ player 1      │           │
                    └──────┬──────┘             │
          ┌────────────────┼────────────────┐  │
   ┌──────┴──────┐                   ┌───────┴──────┐│
   │ player's mallet│                │ player s's mallet││
   │ hits the puck │                │ misses the puck │
   └──────┬──────┘                   └───────┬──────┘│
   ┌──────┴──────┐                   ┌───────┴──────┐│
   │ puck bounces off│               │ other player's││
   │ (rebounds) like a│              │ score + 1     │┘
   │ reflection    │                 └──────────────┘
   └──────┬──────┘
   ┌──────┴──────┐  ┌─────────────┐
   │ puck hits edge of│  │ puck goes   │
   │ the grid    │  │ towards player│
   └─────────────┘  └─────────────┘
```

Task Division:

- Iqra/Rabia are going to work on the gui of the game and make it an interactive one.
- Zoya/bismaa are going to work on verilog and integration with the hardware.

References:

- https://www.youtube.com/watch?v=LqOlgilpCYc
  This video has given us the rough idea of how are game will look like.
- https://youtu.be/tELTeQb-Dc4
  This video has pong game which is giving us the idea of how things like bounces and strikes will work out.
- https://people.ece.cornell.edu/land/courses/eceprojectsland/STUDENTPROJ/2007to2008/pl328/pl328_M_Eng/M_Eng_Design_Proj_Report_PL328.pdf
  This document walked us through the additional details for the game.