EE 314: Digital Circuits Laboratory
Term Project Deliverables
FPGA-Based 2-Player Fighting Game

1 Milestone Report and Demonstration

As part of the project development process, each group is required to submit a **Milestone Report** and give a **Milestone Demonstration**. This serves to track progress and ensure that key foundational components are in place before moving forward.

1.1 Milestone Report: 30$^{\text{th}}$ of May (10% Credits)

The milestone report should provide a concise yet comprehensive overview of the project's progress to date. It must describe the features that have been implemented so far, explain how these features were realized in hardware, and include basic validation artifacts—such as simulation outputs, testbench results, screenshots, or hardware photos—to demonstrate that the functionality behaves as expected.

The report should also address any technical challenges encountered during implementation, how those challenges were resolved, and briefly outline the next steps for completing the project.

A well-prepared milestone report should include the following sections:

1. **Introduction**
   - Brief overview of the project and its objectives.

2. **Theoretical Background**
   - Relevant technical background, with a focus on VGA.

3. **Proposed Solution**
   - Block descriptions and block diagrams.
   - Detailed state diagram.

4. **Results**
   - Testbench results.
   - Picture(s) of implemented step(s).

5. **Challenges and Discussion**
   - Summary of implementation issues and how they were addressed.

6. **Conclusion and Future Work**
   - Summary of progress and remaining tasks.

7. **References**

8. **Appendices (if applicable)**

    - Large figures, full testbench outputs, or extended visuals of state diagrams.

Formatting Requirements:

- Font: Times New Roman, 12 pt.

- Line spacing: Single.

- Maximum length: 3 pages (excluding references and appendices).

- No cover page is required.

1.2 Milestone Demonstrations: 31st May-1st June (20% Credits)

By the milestone, each group is expected to demonstrate the following on the FPGA using VGA output:

- A functional background is displayed on the screen.

- A single character rendered as an arbitrary object.

- Character movement controlled by user input (left and right) and correct visual response when the character is moved to the left or right side of the screen.

- A basic attack input mechanism, including a visual change in the character to represent "attack phases."

- SW[1] is used to switch between 60Hz and a KEY for the clock of Game Logic.

You may assume the player can only assert one of the inputs at any given time. Note that each group member must be present at the Milestone Demonstrations.

2 Final Report, Demonstration, and Video Presentation

At the end of the project, each group is required to present a **Final Demonstration** and submit a comprehensive **Final Report** and a short **Video Presentation**.

2.1 Final Demonstrations: 25th-27th June (50% Credits)

The final demonstration should showcase the fully functional two-player fighting game implemented on the FPGA using VGA output. The game must include:

- A rendered background.

- Two independently controlled player characters.

- Support for player movement and attacks.

- Collision detection, health tracking, and visual feedback for game states such as hits, idle, and victory/defeat.

Smooth gameplay, appropriate input handling, and stable output display are expected. Note that each group member must be present in the Final Demonstrations.

2.2 Final Report: 24th June (15% Credits)

The final report should present a clear, comprehensive, and professionally organized summary of the entire project, documenting both the design methodology and technical implementation in detail. It must provide a complete overview of the game concept, system architecture, and the implementation of critical components such as character rendering, hit detection, input handling, and game logic.

In addition to a detailed technical explanation, the report must include evidence validating the system's functionality. This should include testbench results, gameplay pictures, and hardware behaviour. Students are expected to reflect on the challenges faced throughout the development process, explain how these were resolved, and articulate the lessons learned.

Compared to the milestone report, the final report should offer deeper insights, more detailed explanations, and a clearer demonstration of understanding in digital system design and integration.

A well-structured final report should include the following sections:

1. **Abstract & Keywords**
   - A brief summary of the project and key terms.

2. **Introduction**
   - Overview of the project, its objectives, and scope.

3. **Theoretical Background**
   - Discussion of relevant digital design principles and concepts (excluding VGA-specific content since it is already covered in the milestone report).

4. **Proposed Solution**
   - Detailed explanation of the system architecture.
   - Block descriptions and corresponding block diagrams.
   - State diagram(s) with appropriate explanation.

5. **Results**
   - Testbench results.
   - Photos or screenshots of implemented hardware and gameplay output.

6. **Challenges and Discussion**
   - Description of technical difficulties encountered during development.
   - Solutions or workarounds applied, with reasoning.

7. **Conclusion**
   - Summary of accomplishments.

8. **References**

9. **Appendices (if applicable)**
   - Supplementary materials such as large diagrams, extended testbench results, or visualizations of state machines.

Formatting Requirements:
- Format: IEEE double-column.
- Maximum Length: 4 pages (excluding references and appendices).
- No cover page is required.

2.3 Video Presentation: 24th June (5% Credits)

Each group must submit a 5–8 minute video summarizing their project. The video should briefly explain the game concept, highlight key features and implementation details, and include a live demonstration of the game running on the FPGA. It must be clear and concise, suitable for both technical and general audiences. All group members should participate equally, and when speaking, each person's face must be clearly visible, with effective body language and eye contact with the camera. The video can be recorded

offline or through a meeting app, but visibility and presentation standards still apply. You can upload the video directly to ODTUClass if it is under 1GB. If the file is too large, upload it to a platform like YouTube or Google Drive and submit the link. Make sure the video is accessible—otherwise, it will not be graded.

Changelog

- V1.0: Initial version of the document

- V1.1: Added clarification for the input during milestone demonstration, where the user will only press 1 button at a time.