

Proposal: Nintendo Entertainment System (NES) Emulator

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INTRODUCTION

Our project goal is to implement a Nintendo Entertainment System (NES) emulator. The NES was Nintendo's first flagship console, released in 1985. It relies on MOS Technology 6502 8-bit CPU (popular in other hardware of the time including the Apple II), similar (in historical context) to the Zilog Z80. There are numerous attempts at implementing such emulators which can be referenced during development [2] [1].

The project will attempt to emulate the audio, video, and controller of the NES via the DE1-SoC development board. The original controller will be interfaced to the FPGA, and ROM's will be loaded via the Linux host. The criteria for the project's success include playing original NES titles using our implementation. This includes the original *Zelda*, *Final Fantasy* games, etc.



Figure 1: Nintendo Entertainment System

GOALS

Instead of implementing the entire system from scratch, initially our team will rely on a preexisting implementation of the 6502 CPU in Verilog and implement the remaining hardware necessary to fully emulate the system. These include:

1. Video: Graphics processing/interface to hardware.
2. Controller: Purchase and implement an actual NES controller.
3. DMA for game loading.
4. Software: Linux host for loading ROM's onto the device.
5. Audio: Moderate hardware for implementing minimal sound.

Currently, a non-goal (or rather, stretch goal) is implementation of the 6502 itself. If time permits, our group will re-implement the existing Verilog implementation in Systemverilog.

MILESTONES

1. Initial development/research for CPU implementation.
2. Video interface.
3. NES controller implementation.
4. ROM loading/software control.
5. Audio implementation and testing.

REFERENCES

- [1] Chip-8. <http://www.cs.columbia.edu/~sedwards/classes/2019/4840-spring/reports/Chip-8-presentation.pdf>, Spring 2019.
- [2] Sgameboy. <http://www.cs.columbia.edu/~sedwards/classes/2019/4840-spring/reports/GameBoy-presentation.pdf>, Spring 2019.