Preliminary Project Proposal

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Project Title

Sega Game Gear on a Chip (SGGoC)

Problem Statement

Since the introduction of gaming consoles there has been much effort put into emulating these systems in software on computers. There has not, however, been as much effort put into the physical reimplementation of their hardware. A brief survey shows only a handful of projects that have reimplemented game consoles such as the Nintendo NES, the TurboGrafx-16, and the Gameboy on FPGAs. The Sega Game Gear, however, seem to be untouched as we were not able to find an open source FPGA reimplementation. We believe reimplementing these classic game consoles in hardware is an important part of understanding, documenting, and educating people on their design and functionality. For our project we plan to fully recreate the Sega Game Gear hardware on a FPGA.

Potential Approaches

The Game Gear hardware can be easily broken down into submodules. Major components include the Zilog Z80 CPU, the Video Display Processor (VDP) which is a modified Texas Instruments TMS9918, the Sega IO controller, and the game cartridge memory mappers. The implementation of the Zilog Z80 is outside the scope of this project and as such we will be using the popular open source TV80 CPU. A memory management unit will be developed to coordinate the addressing of system RAM and the cartridge ROM. The cartridge ROM will initially be preloaded on a flash memory chip on our development board. If time allows a proper bootloader may be developed to allow game ROMs to be selected off a SD card. The general approach to this project will be to develop and test small modules at a time.

Final Implementation Description

Our final implementation will be a fully functioning Sega Game Gear running on an Altera DE-1 FPGA development board. Video output will be via VGA to a computer monitor and input will be through some type of retro gaming controller, such as the Sega Genesis controllers. Any Sega Game Gear ROM which uses the Sega mapper (we do not plan on implementing on less common mappers) will be playable.

Team Participants

Max Thrun - FPGAs / computer architecture / programming
Samir Silbak - Linux / embedded systems / software development

Advisor

No confirmed advisor. Possible advisors are Carla Purdy, George Purdy, or Philip Wilsey.