SD Host Controller: Project Proposal

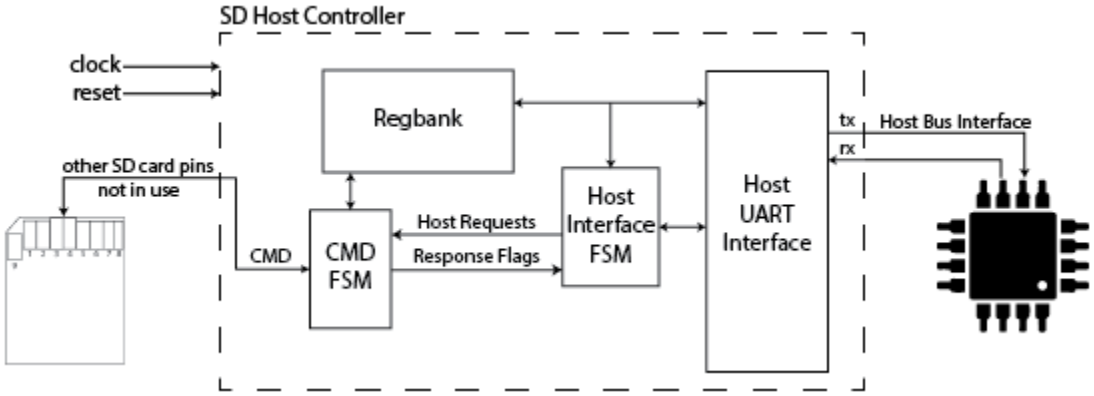
Group: Kressa Fox, Kristopher Wolff

Motivation:
SD cards are a great external memory source for many embedded systems: such as saving application data, images or videos. With a simple direct-mapping SD card protocol, your system is limited to 2GB, limiting your space and usability. For projects in need of more external memory, writing to SD cards with more memory requires a higher level communication protocol in order to properly write to these cards. This proposal is to design a microcontroller for communicating with SD cards of any size. This way, the controller can be added to an embedded system used to help communications between an ARM processor and SD card(s).

High Level Description:
This project's purpose is to build a microcontroller for initializing the connection to an SD Card. The microcontroller is responsible for sending the commands required to correctly initialize contact with the SD card, receiving and checking the responses from the card, and sending back any errors found during the process. It utilizes its own internal state logic, allowing existing processors to simply send a read/write command to the microcontroller rather than handling the communication protocol itself.

Here we assume that the processor will communicate with our controller with a communication protocol through UART communications at a baud rate that will need to be defined after testing as this will be dependent on datapath timing analysis. This communication protocol will allow for future implementation of communication with the SD Card, such as implementing reading data from and writing data to the SD card. This communications protocol will be provided for the final report, but will be developed with the SDHC.

Functional Block Diagram:



Testing options:
Most of the testing will be done incrementally across the entire scope of the project. Each segment of the block diagram will be independently developed, then thoroughly tested. The first

step is to develop the overarching state machine for interfacing with the SD chip. Ensuring the correct signals produce the correct output signal is integral to ensuring the microcontroller works. From there, smaller modules that ensure the correct communication protocols with the SD card itself will require extensive testing, such as the implementation of a CRC. Since we are interfacing with what is another “black box” microcontroller, we will need to be thorough in ensuring the commands sent are correctly interpreted and read by the SD card. Finally, after ensuring that the FSM and sub-modules are correctly implemented, we will focus on incoming signals from the Host processor, and overall testing of each bus between components. All of these tests will be run with testbenches in ModelSim, allowing us to view the proper responses to selected inputs.

Required pins: 7 pins

	VCC, GND, CLOCK, RESET
From SD Card:	**SD_CMD**
From Host:	**HOST_TX, HOST_RX**

Do you plan on fabricating your design: No

[1] “*Physical Layer Simplified Specification Version 1.10”*, SD Card Association, San Ramon, CA, USA, March 18, 2005. Accessed on: Oct. 20, 2020. [Online] Available: https://www.sdcard.org/downloads/pls/archive/index.html.