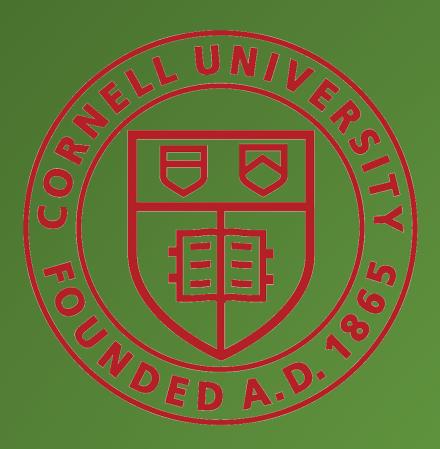
This project aims to design and develop a secure digital (SD) card library based on PIC32 microcontroller. The main function of this system is to read and store files from the SD card. In addition, this system gives PIC32 developers access to large memory to store image and files. It also serves for later projects need SD card implementation. Thus, by using the library, the later PIC32 developers can get the information and write data to the SD card easily. The basic functions in the SD card library are write and read functions. The user can access the file stored in the SD card with calling a read function in the library.

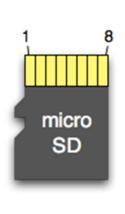
# Abstract





## SD card in the eye of engineers

SD card is a common daily life erasable storage device, because of its large storage capacity and low price, it is widely used in digital cameras, mobile phones and other digital products. SD card supports two bus modes: SD mode and SPI mode. SD mode using 6-wire buses, the use of CLK, CMD, DAT0, DAT1, DAT2, DAT3 for data communication, which has the data transform rate at 4bits at a time. SPI mode using 4-wire buses, the use of CS, CLK, DataIn, DataOut, these four ports for exchanging data only has 1 bit at a time which is slower than the SD mode, but the communication protocol is simple and there is no need to check the CRC, which is desirable for this project to read and write operations on the SD card.



SD SPI	
DAT2	x
CD/DAT3	CS
CMD	DI
VDD	VDD
CLK	SCLK
VSS	VSS
DAT0	DO
DAT1	x
	DAT2 CD/DAT3 CMD VDD CLK VSS DAT0

Figure 1. SD card pinout

## SD card increases 1000 times storage of PIC32

The current situation in ECE4760 PIC32 developers is that there is a lack of library for them to directly access the file stored in an SD card. To enhance the feasibility and capability of the use of PIC32, a SD card library is needed to be created. Therefore, the developers are able to read, write or update information in the system directly.

According to our research, including the secondary research on the internet, we find that it is feasible and potential to enrich this peripheral for PIC32 developers. This improvement will contribute to the convenience for PIC32 developers in their work. Thus, this project aims to design and develop a secure digital (SD) card library based on PIC32 microcontroller.

The SD card library offers a place to store data, images, sound and other information which needs of large memory space. The main function of the library is to read and store files from the SD card. In addition, this library provides the functionality to get the file list from the root directory.

Without SD library, PIC32 has 512KB memory storage With the SD library, now it is up to **32GB**!

Acknowledgments

Special thanks to Bruce Land, advisor of this Masters of **Engineering Design Project** 

# **SD Card Library For PIC32**

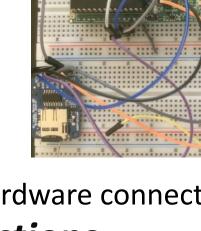
## Chang Liu & Pei Xu Advisor: Dr. Bruce Land School of Electrical and Computer Engineering, Cornell University

### **SPI** Section

via SPI can be written and read through SPI1BUF from PIC32.

### Hardware Design

Pin Number on SD card	Name	Description	Physical pin Number on PIC32	• •	
1	CS	Chip select (active low)		Name	Description
2	MOSI(DataIn)	Master out slave in	FIC32		
3	V <sub>SS1</sub>	Ground	6 (RB2)	CS	Chip select (active low)
4	V <sub>DD</sub>	Voltage supply	24 (RB13)	MOSI(SDO1)	Master out slave in
5	CLK	Clock	27 (GND)	GND	Ground
6	V <sub>SS2</sub>	Ground	25 (RB14)	SCK1	Clock
7	MISO(DataOut)	Master in slave out	22 (RB11)	SDI1	Master in slave out
8	Reserved	Reserved for SPI mode	3 (RA1)	U2RX	UART receive
9	Reserved	Reserved for SPI mode	21 (RB10)	U2TX	UART transmit

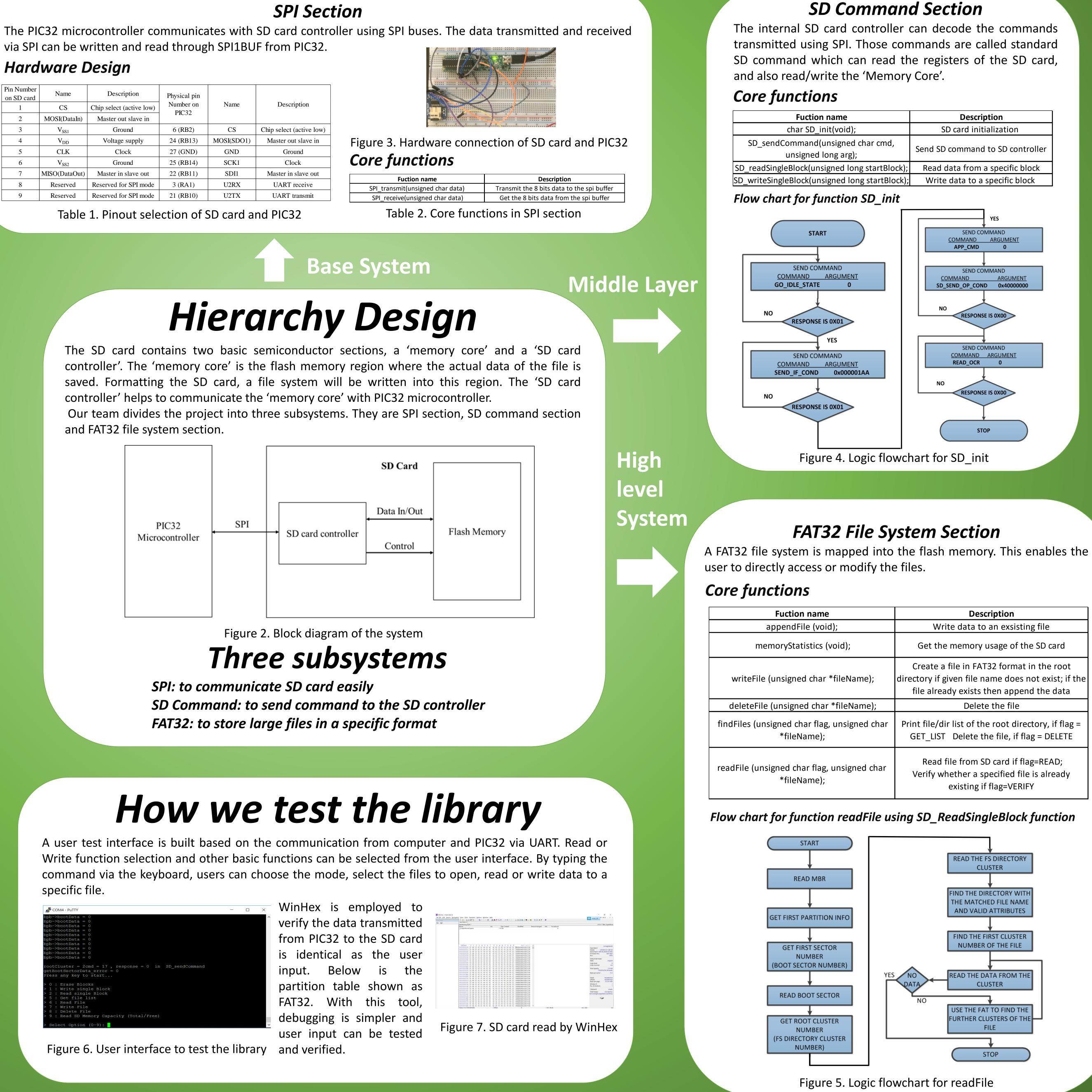


SPI receive(unsigned char data)

Table 1. Pinout selection of SD card and PIC32



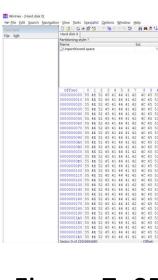
controller' helps to communicate the 'memory core' with PIC32 microcontroller. and FAT32 file system section.



specific file.



Figure 6. User interface to test the library



on
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o SD controller
specific block
ecific block