SD CARD DATALOGGER

RAVI PRAKASH (EE24MT017)

YADU KRISHNAN (EE24MT013)

|| सा विद्या या विमुक्तये ||

ಭಾರತೀಯ ತಂತ್ರಜ್ಞಾನ ಸಂಸ್ಥೆ ಧಾರವಾಡ

भारतीय प्रौद्योगिकी संस्थान धारवाड

Indian Institute of Technology Dharwad

PROBLEM STATEMENT

Storing a string of data in a continuous data locations into the SD card, which can be used for data logging purpose.

FUNCTIONS IMPLEMENTED

1. **Auto Initialization on Startup**: The system automatically initializes and checks SD card compatibility on boot.
2. **LED Indicators**: LED indicators are used to simplify the selection of different operation modes.
3. **SD Card Read Functionality**: Added the ability to read data from the SD card for easy verification of written data.
4. **Three Operation Modes**: The system supports three modes of operation - sector read, sector erase, and sector write. Users can select the mode using push buttons.
5. **Serial Interface**: Enabled serial communication to monitor the microcontroller's operation step-by-step via a serial monitor on a PC.

IMPLEMENTED PROGRAM FLOW

Startup:

Initialize all peripherals.

Initialize the SD card and check its compatibility, while displaying debugging information on the PC serial monitor.

Enter a while loop, waiting for input from button SW1 to select the operation mode. The selected mode is indicated by an LED, and confirmation is required by pressing SW2.

1. Read Operation:

Debugging information is sent via serial communication.

The necessary commands are sent to the SD card to read a sector.

The received data is saved to an array.

After completion, the function exits, and the system returns to the main loop, waiting for the next mode selection.

2. Data Erase:

Debugging information is sent via serial communication.

This operation writes 0x00 to all data locations in the selected sector.

Commands are sent to the SD card to perform the write operation.

After successful completion, the function exits and returns to the main loop to wait for mode selection.

3. Data Write Operation:

Debugging information is sent via serial communication.

The necessary commands are sent to the SD card to write data.

The string data is written to the first location, followed by 0x00 written to the remaining locations.

After successful completion, the function exits and the system returns to the main loop, waiting for mode selection.

FLOW CHART (PROGRAM FLOW)

1. Set up the clock and configure the GPIO pins for SPI communication and the input button switch.
2. Monitor for a button press..
3. When a button press is detected, initialize the SD card and erase its contents.
4. Write a small string (e.g., "abcdefg") of data to the SD card in a continuous location (without using a file format).
5. Wait for the next button press, and if detected, repeat the process starting from step 3.
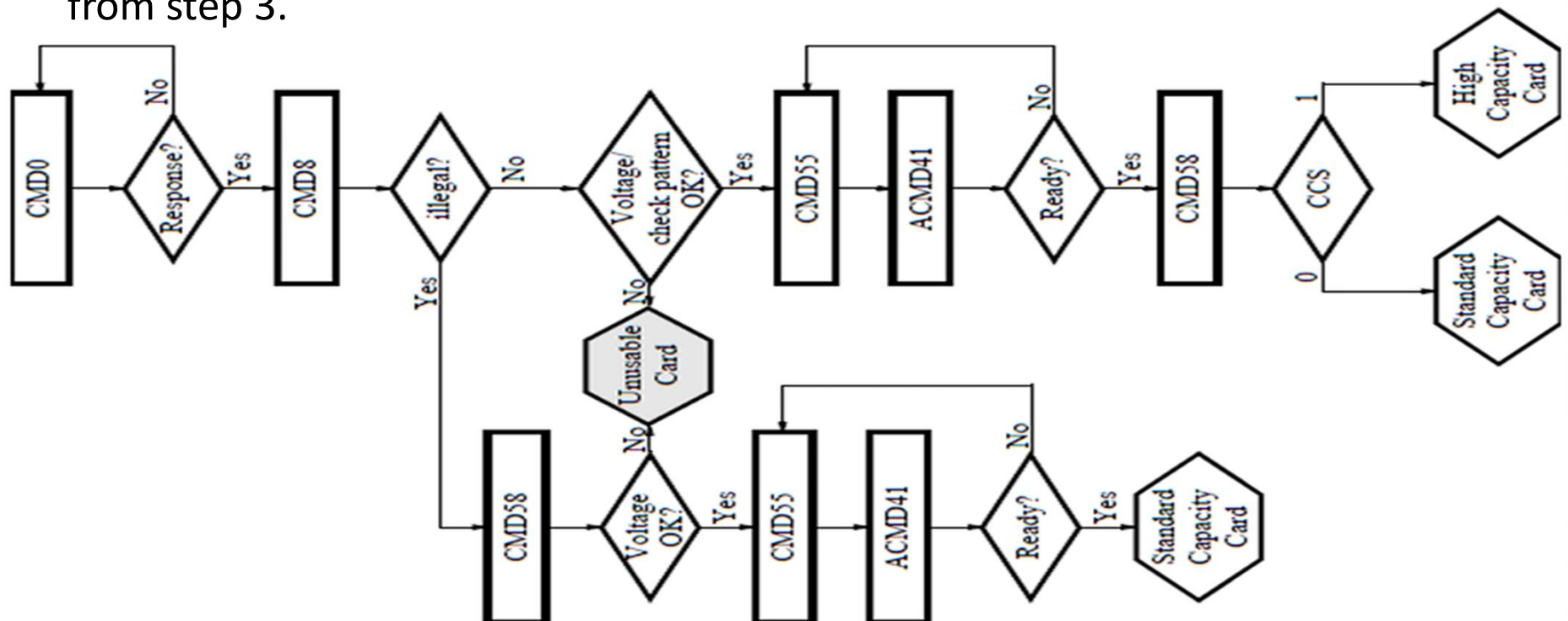
COMMANDS USED

1. **CMD0: Reset Command** –When card supports boot functionalities and receives this command as the first one in idle state after power up, the argument is regarded as the bus mode in Fast Boot.
2. **CMD8: Interface Condition** - Sends SD Memory Card interface condition, which includes host supply voltage information and asks the card whether card supports volage.
3. **CMD55: Application-Specific Command** - Sets the context for the next ACMD.
4. **CMD41: Card Initialization** - Initializes the card and clears the idle state.
5. **CMD58: Operating Conditions Register (OCR)** - Provides card-specific details like voltage and type.
6. **CMD16: Set Block Length** - Configures the data block size.
7. **CMD17: Read Single Block** - Reads 512 bytes from a specific location.
8. **CMD24: Write Single Block** - Writes 512 bytes to a specific location.

CMD Index	Argument	CMD Description
CMD0	[31:0] stuff bits or bus mode in fast boot	When card supports boot functionalities and receives this command as the first one in idle state after power up, the argument is regarded as the bus mode in Fast Boot
CMD8	[31:12] reserved [11:8] VHS [7:0] check pattern	Sends SD Memory Card interface condition, which includes host supply voltage information and asks the card whether card supports voltage
CMD16	[31:0] block length	In the case of a standard capacity SD memory card this command sets the block length (in bytes) for all following block commands (read, write, lock). Default block length is fixed to 512 bytes
CMD17	[31:0] data address	In case of Standard Capacity SD Card, this command reads a block of the size selected by CMD16
CMD24	[31:0] data address	Write a single block of data (typically 512 bytes) to the SD card at a specific address in SPI mode
CMD41	[47:46] Start bits (01) [45:40] Command index [39:8] Argument [7:1] CRC 0 Stop bit	Used during the initialization process of an SD card in SPI mode. It prepares the card to operate and transitions it from the idle state to the ready state. This command works alongside CMD55 (Ensures card is ready for use)
CMD55	[31:16] RCA [15:0] stuff bits	Used to indicate that the next command is application-specific (ACMD). Without CMD55, the SD card will interpret the subsequent command as a standard command instead of an ACMD (Prepares card for ACMD commands)
CMD58	[47:46] Start bits (01) [45:40] Command index [39:8] Argument [7:1] CRC 0 Stop bit	Used to read the Operating Conditions Register (OCR) of the SD card (Checks card voltage and type)

Thank You