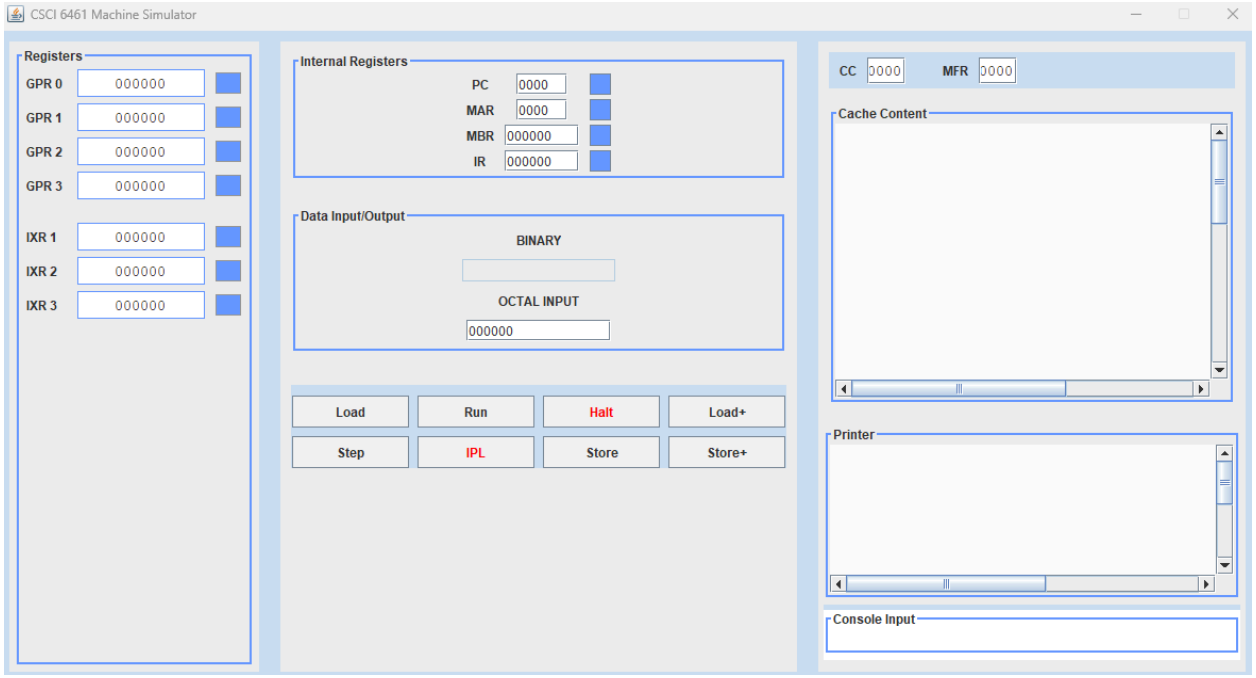
CSCI 6461 Machine Simulator Documentation - Team 12

https://github.com/jayparmar16/csci_6461_Group12/tree/Project2

1. The Console Layout

The simulator interface is divided into three main columns: Registers (left), Operations (center), and I/O (right).



2. Left Panel: Registers

This panel displays the primary user-accessible registers.

GPR 0-3 (General Purpose Registers): Four 16-bit registers for general data manipulation.
IXR 1-3 (Index Registers): Three 16-bit registers used for indexed addressing calculations.
Register Buttons: The small blue buttons next to each GPR and IXR are non-functional placeholders. To load a value into these registers, you must use instructions like LDR or LDX from a program.

3. Center Panel: Operations & Internal State

This panel contains internal CPU registers, data input fields, and the main control buttons.

Internal Registers:

PC (Program Counter): A 12-bit register that holds the address of the next instruction to be executed.
MAR (Memory Address Register): A 12-bit register that holds the address of the memory location to be accessed.
MBR (Memory Buffer Register): A 16-bit register that holds the data being transferred to or from memory.
IR (Instruction Register): A 16-bit register that holds the current instruction being executed.
Load Buttons: The small blue button next to each internal register allows you to load a value directly from the OCTAL INPUT field into that specific register.

Data Input/Output:

BINARY: A read-only field that displays the 16-bit binary equivalent of the value in the OCTAL INPUT field.
OCTAL INPUT: The primary field for manual data entry. All values for registers or memory operations are entered here as octal numbers.

Operation Buttons:

IPL (Initial Program Load): The most important button. Click this to open a file dialog and load a program file into the simulator's memory. This resets the machine state.
Run: Executes the loaded program continuously until a HLT instruction is encountered or the Halt button is pressed.
Step: Executes a single instruction at the address pointed to by the PC.
Halt: Stops a continuously running program.
Load / Store: Executes a memory load/store operation using the value in the OCTAL INPUT field as the memory address.
Load+ / Store+: Similar to Load/Store, but first increments the PC before performing the operation.

4. Right Panel: I/O & Status

This panel displays status information, memory content, and program output.

Status Registers:

CC (Condition Code): A 4-bit register that stores the status (e.g., overflow, underflow) of the last arithmetic operation.
MFR (Machine Fault Register): A 4-bit register used to identify the type of machine fault that has occurred.
Cache Content: A text area that displays the contents of the machine's memory (2048 words). The display is formatted as Address: Value. **(Not Implemented Yet)**
Printer: A text area that shows a detailed log of each instruction as it is executed. This is useful for debugging and tracing program flow.
Console Input: A field for providing input to a running program when required by an input instruction.

5. How to Operate the Simulator (Detailed Steps)

Follow these steps to load and run a program.

Step 1: Start the Simulator

Run the application. The simulator window will appear with all registers and memory initialized to zero.

Step 2: Load a Program via IPL

- Click the IPL button. It is highlighted in red for emphasis.
- A file chooser dialog will open. Navigate to and select your program file (e.g., load_file.txt).
- Click Open.
- The simulator will load the program into memory. The PC will automatically be set to the starting address specified in the program file (e.g., 0006).

Step 3: Run and Enter the Input

- Once IPL is done, click **Run.**
- Enter the input in the console input box present in the bottom right corner of the GUI.
- The format of the input is as **follows:**
- ***Target Num1 Num2 Num3 Num4 Num5 Num6 Num7 Num8 Num9 Num10 Num11 Num12 Num13 Num14 Num15 Num16 Num17 Num18 Num19 Num20***
- **Example**: -4 9 9 9 9 9 9 9 9 9 9 -3 -5 9 9 9 9 9 9 9 9
- For more examples, please check the README.md file
- Once input is typed in the console input, press **Enter** once.
- After a few seconds of processing, you will see the **output** appear in the **Printer tab.**

Step 4: Halting and Resetting

- To stop a program that is running continuously (e.g., if it's in an infinite loop), click the Halt button.
- To reset the machine and load a new program (or the same one again), simply go back to Step 2 and click the IPL button. The IPL process always resets the machine state before loading the new file.