Khulna University of Engineering & Technology

Department of Computer Science and Engineering

Project Report

Submitted By

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Topic : 21 bit Mini computer design using Logisim.

Course No. : CSE 2114

Course Name : Computer Architecture

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Submitted To

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Objectives:

- To develop a minimal computer system using “Logisim” software, along with components like central processing unit (CPU) and a main memory.
- To learn implementation of ALU, registers, instruction set architecture, MAR, MBR, IR, control unit, CPU and main memory (RAM) in minimal computer system.
- To implement various instructions like AND, OR, NOR, BRANCH,LOAD,SOTRE,ADD,SUB,MUL & HALT.
- To understand how an instruction is fetched to a computer and how it functions internally.

Introduction:

Introducing the small computer system we have: including a wealth of important instructions, like branch, stop, add, sub, load, store, mul, and and. It consists of important parts including the control unit, CPU, main memory, MAR, MBR, IR, ALU, and accumulators in addition to complex algorithms like Booth's Algorithm. Designed with customization and efficiency in mind, it offers powerful features

Component	Description
Word Size	21 bits
OP-Code	4 bits
RAM Address Size	12 bits
Architecture	21-bit architecture with 12-bit RAM addressability

Instruction Format: (21 Bits)

Don’t Care	Op-Code	Memory Address
5 bits	4 bits	12 bits

Instruction set with opcode:

0 – AND : perform logical and operation between two operands.

1 – ADD : perform addition between two operands.

2 – STORE : store the result of the operation in memory.

3 – OR : perform logical OR between two operands.

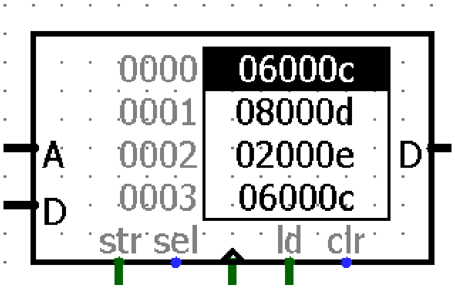
4 – SUB : perform subtraction between two operands.

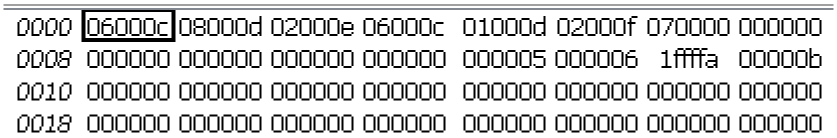
5 – BUN : branch unconditionally.

6 – LDA : loads data from memory to accumulator.

7 – HLT : halt the CPU.

Sample program:





```
0000 06000c 08000d 02000e 06000c  01000d 02000f 070000 000000
0008 000000 000000 000000 000000  000005 000006  1ffffa  00000b
0010 000000 000000 000000 000000  000000 000000 000000 000000
0018 000000 000000 000000 000000  000000 000000 000000 000000
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Discussion:

The CPU stores both data and instructions in the same memory, using the simple Von Neumann architecture. Only a few simple tasks are carried out here. A single clock pulse is used to complete each action. The Logisim simulator has all of these designs implemented. Every arithmetic and logical action on data kept in registers is handled by the CPU's ALU. ALUs that can execute addition, subtraction, AND, OR, and multiplication can be designed with the help of Logisim's tools. The data and instruction flow inside the CPU is regulated by the control unit. Our system provides enough of storage and memory access capabilities with a 12-bit RAM addressability and a 21-bit accumulator. Depending on whatever instruction is being executed at the time, it regulates how other CPU components operate.