

# Simple 8-bit Processor

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## Abstract

A Simple 8-bit processor is described and implemented in Verilog HDL. The design features 16 byte RAM (16 addresses each of 8 bit word length) and 2 general purpose registers. The Instruction Set is capable of supporting 16 possible instructions of which 11 instructions are implemented. Far from a practical use, the design is modular and Education centric.

## 1. Description

Processors are digital circuits which are capable of executing instructions, preserving their current state and making decisions based on their previous state. This design aims to implement a bare minimum, Turing complete processor to demonstrate what any modern processor does but at a large and complex scale.

The design can handle 8 bits of data each clock cycle with its two 8 bit GPRs and an 8 bit ALU. It is capable of addressing 16 addresses from the primary memory.

The instruction set can handle 16 instructions of which 11 instructions are implemented. Each instruction is a byte long, the upper half being used for opcode and the lower half for data. The architecture supports Immediate and Absolute data addressing modes.

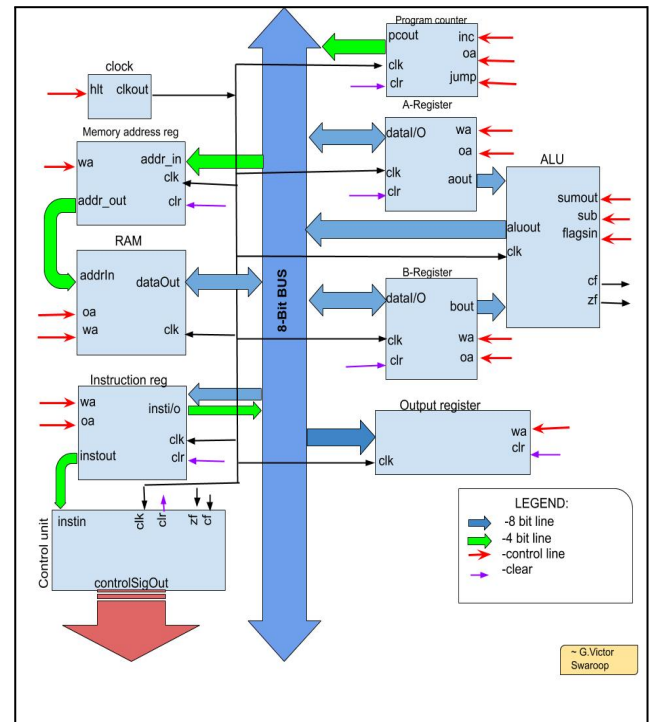
## 2. Architecture and Timing Diagram

Architecture diagram tries to convey the entire design as a combination of smaller and modular units.

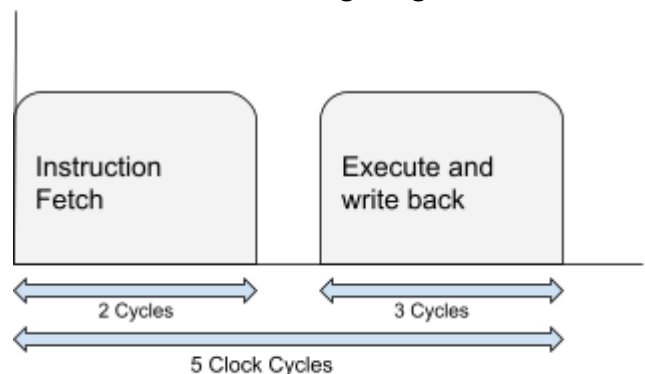
Timing Diagram is the depiction of different phases in which an instruction is executed. Each instruction starts with a fetch cycle to fetch the instruction from the memory to the instruction register. Each fetch takes 2 clock cycles. The rest of instruction execution takes 3 clock cycles making each instruction 5 cycles long.

The design is implemented in Verilog HDL and gtwave is used for Timing verification.

### 3. Architecture Block Diagram



#### 4. Timing Diagram



## References

[1] G.Victor Swaroop “simple-8bitComputer”  
<https://github.com/GVictorsd/simple-8bitComputer>

[2] Ben Eater "Building an 8 bit breadboard computer"