<u>In the name of God</u>

Computer architecture project's report

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Modules list:

WP.vhd

Tristate.vhd

ShiftRight.vhd

ShiftLeft.vhd

SAYEH.vhd

RegisterFile.vhd

PC.vhd

Or.vhd

Not_Gate.vhd

Memory.vhd

MainModule.vhd

IR.vhd

Flags.vhd

DataPath.vhd

Controller.vhd

Comparator.vhd

BitSubtractor.vhd

BitAdder.vhd

And_Gate.vhd

ALU.vhd

AddressUnit.vhd

AddressLogic.vhd
16bitSubtractor.vhd
16bitAdder.vhd

Address Unit:

This part includes Program Counter and Address Logic that has been implemented based on the example code in project.

ALU:

This part has been implemented using inner functions of vhdl.
Adding function is implemented with a 16 bit Adder which is made of a bit adder. Subtracting has the same process.

Windows Pointer:

It has a 6 bit vector for holding base integer, clock, reset and add signals.

RegisterFile:

Insists of a 64 bits array of 16 bits vectors as registers. for calculating the address of the memory words as there is not any carry we converted them to unsigned and used vhdl adding tool.

Instruction Register:

Includes a 16 bit vector for holding instruction, clock, load signals and output.

Control Unit:

This part is designed like a FSM machine which has the below states:
reset
halt
fetch
memRead
exec
execsta
execlda
exec2
exec2lda
exec2sta
incpc

reset:

The primary state of control unit switches to fetch state after the external reset turns off.

halt:

This is the state in which the control unit has stopped. External reset is the only signal that switches this state to reset state.

fetch:

The mission of this state is to send signals which is related to memory so that in the next state instruction registers are available for loading. After the activation of these signals the current state switches to memRead state.

memRead:

It activates the load signal of the instruction register for loading instructions from database to this register.

exect:

In this state two parameters will be checked:
1_Whether the instruction is shadow or not. as a contract the instructions with the right bits like 00001111 are not shadow. Also if they are immediate they are not shadow either.
2_Execute the instruction and determine the next state base on instruction and being shadow or not.

exectsta:
Includes sta operations.

exectlda:
Includes lda operations.

exect2:
It will execute the shadow instruction.

exect2lda:
Includes lda operations. (when the instruction is shadow)

exect2sta:

Includes sta operations. (when the instruction is shadow)

incpc:

It will increment the program counter and switch to fetch state.

**In each of above states when the external reset is activated in the rise edge of clock all the operations will be stopped immediately and it switches to reset state.