**Digital Electronic**

**Simple CPU Design**

**Introduction:**

A central processing unit (CPU) (formerly also referred to as a central processor unit) is the hardware within a computer that carries out the instructions of a computer program by performing the basic arithmetical, logical, and input/output operations of the system. The term has been in use in the computer industry at least since the early 1960s. The form, design, and implementation of CPUs have changed over the course of their history, but their fundamental operation remains much the same.

A computer can have more than one CPU; this is called multiprocessing. All modern CPUs are microprocessors, meaning contained on a single chip. Some integrated circuits (ICs) can contain multiple CPUs on a single chip; those ICs are called multi-core processors. An IC containing a CPU can also contain peripheral devices, and other components of a computer system; this is called a system on a chip (SoC).

Two typical components of a CPU are the arithmetic logic unit (ALU), which performs arithmetic and logical operations, and the control unit (CU), which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary.

Not all computational systems rely on a central processing unit. An array processor or vector processor has multiple parallel computing elements, with no one unit considered the "center". In the distributed computing model, problems are solved by a distributed interconnected set of processors.

In this term project, the focus will on the design & design verification of a simple CPU. We will be given the instruction set, its simulator (SimpleCPU.exe on Windows), assembly to machine converter (SimpleCPU.exe), Verilog testbench and we are expected to

design and verify our simpleCPU design using the Verilog testbench.

**Design:**

**State Diagram:**



**Bcd:**



**Scan\_Unit:**



**Simple Cpu:**



**Sseg:**



**Top:**



**Implementation & Results:**

**Timing Summary:**

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Speed Grade: -5

Minimum period: 8.319ns (Maximum Frequency: 103.265MHz) Minimum input arrival time before clock: 4.458ns

Maximum output required time after clock: 4.080ns Maximum combinational path delay: No path found

**Device utilization summary:**

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Selected Device : 3s1200efg320-5

Number of Slices: 606 out of 8672 6% Number of Slice Flip Flops: 260 out of 17344 1% Number of 4 input LUTs: 1139 out of 17344 6% Number of IOs: 17

Number of bonded IOBs: 17 out of 250 6%

Number of BRAMs: 2 out of 28 7%

Number of MULT18X18SIOs: 2 out of 28 7%

Number of GCLKs: 1 out of 24 4%

**Conclusion:**

Consequently, in this project we design a simple CPU. This CPU process a assembly code given and create a true output.