Instituto Tecnológico de Costa Rica
Área Académica de Ingeniería en Computadores

Proyecto de Diseño en Ingeniería en Computadores

TEC | Tecnológico de Costa Rica

Progress report #6 for the project: Design of (ASIPs) for Approximate Computing

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1 Performed activities

1. **Implement the ASIPs in the error tolerant applications found (ID 03)**: The
   sob assembly instruction was implemented for the Sobel algorithm. This allows computing the following operation in a single cycle:

$$rd = a * a + b * b \tag{1}$$

   The operation described in (1) allows the execution of two multiplications and an
   addition operation, which is used frequently in the Sobel algorithm. Other operations
   in this algorithm could not be turned into special instructions (for example, a matrix
   multiplication) because they require more than two paremeters.

2. **Implement two small assembly codes for each special instruction developed
   (ID 10)**: The manually-written version of the assembly code for the *sob* instruction
   was implemented with the same format as the previous two assembly codes (explained
   in the previous report).

3. **Compare execution time, area and power vs error in selected applications
   (ID 09)**: Comparison at a simulation level was performed, with an amount of lower
   total cycles found for the programs with the special instruction implemented (as expected). With the *sob* instruction, nearly a 53% reduction of the total cycles was
   achieved. Power and area were also compared, but little difference was found in the
   results. The special instructions used around 1% more area and around 0.005W more
   power, due to the fact that the special instructions do not add much hardware compared to the processor in general. This results were only simulated since there is not a
   hardware platform available for the implementation.

2 Scope Changes

The total number of approximate applications has been re-modified to 3, with the last one
being the *sob* instruction implemented during this last period.

3 Earned Value analysis

The project is almost on schedule, the tasks that were worked on are at 90% because approval from the supervisor is being waited. In general, the tasks have taken less effort than
expected, mainly due to the fact that the scope has been modified because of all the difficulties
encountered through the project.

Table 1 summarizes the gained value analysis.

Table 1: Earned Value

Activity ID	Activity	Budget	%Planned Value	PV	AC	%Completed work	EV	CPI	SPI	Initial planned date	Ending date	Initial real date	Real ending
01	Get to know the software platform	32	100%	32	34	100%	32	0.94	1	Week 1	Week 3	Week 1	Week 7
02	Find appropiate error-tolerant Applications	32	100%	32	20	100%	32	1.6	1	Week 4	Week 6	Week 4	Week 10
03	Implement the ASIPs in the error tolerant applications found	64	100%	64	40	90%	57.6	1.44	0.9	Week 7	Week 12	Week 9	-
04	Write Project Plan Document	8	100%	8	10	100%	8	0,8	1	Week 1	Week 2	Week 1	Week 3
05	Write Requirements Document	8	100%	8	6	100%	8	1,33	1	Week 2	Week 3	Week 2	Week 4
06	Write Design Document	8	100%	8	7	100%	8	1.14	1	Week 3	Week 4	Week 3	Week 5
09	Compare execution time, area and power vs error in selected applications	32	75%	24	15	90%	28.8	1.92	1.2	Week 12	Week 16	Week 12	-
10	Implement two small assembly codes for each special instruction developed	16	100%	16	12	90%	14.4	1.2	0.9	Week 11	Week 13	Week 11	-
	Total			192	144		188.8	1.31	0.98				

4 Difficulties Encountered

- The server nodes in which the tools like ASIPMeister and Dlxsim work properly were turned off daily at 12:00 pm in Germany (4:00 pm in Costa Rica) for the reported period, so the time frame for possible work was reduced.

5 Hard Skills Required/Acquired

- Knowledge in the following software frameworks has been acquired: ASIPMeister and Dlxsim.

- Knowledge in HDL has been reinforced.

6 Soft Skills Required/Acquired

The following soft skills have been excercised:

- Self-Motivation: Given that there is no direct round-the-clock supervision, self-motivation

has been key in working continously with the ASIPMeister and Dlxsim on the creation of special instructions for the approximate applications.

- Communication: Remote communication has been performed with Jorge Castro for the guidance of this project.

7 Lessons Learned

There are no lessons learned for the reported period.

References