Intermittent Computing

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***Abstract*—** *Intermittent Computing is applicable to devices that harvest energy from their surroundings when it is available, and store these bursts of energy for computations, thereby eliminating the need for a power source. The energy is not always available continuously and is therefore termed as intermittent. Nowadays, many applications such as medical sensors, small satellites etc., are expected to perform computations with small amounts of power and time. Therefore, energy distribution becomes critical and we allot this limited energy and time to more frequently occurring and meaningful computations. These devices comprise of hardware elements such as a CPU, sensors, transceivers, volatile memory, in which data is lost on power exhaustion and non-volatile memory, in which data is retained even on power exhaustion. To cater to this time constrained operation, we are replacing the conventional main memory with a memristor based memory device, which has access times that are approximately 100 times faster. These energy-starved devices are also more acceptable of approximate results for the mathematical computations. In this project we aim to generate approximate, yet acceptable results in a shorter duration of time and for smaller amounts of energy, for which we propose an architecture that is like What’s Next Intermittent Computing Architecture paper but improving upon it by choosing a Memristor device as opposed to a conventional main memory, by designing another approximate multiplier design.*

***Keywords-****energy harvesting, intermittent computing, approximate computing, memristor****;***

I. *INTRODUCTION*

In recent years, small and low-power computing devices are seeing increased shifts in technology trends, towards numerous application domains such as medical sensors, implantable devices, satellites and computer vision. These devices operate using energy exclusively from the environment. These battery-less devices are powered entirely by energy gathered from environmental sources such as radio waves, solar light or vibration.

These devices present a unique challenge in terms of energy consumption as energy is not continuously available, but it is available intermittently in bursts, and all the meaningful computations must be done in the time during which the energy is available for. Such devices are also more accepting of approximate results and are error tolerant.

1. A Reconfigurable Energy Storage Architecture for Energy-harvesting Devices
2. The What’s Next Intermittent Computing Architecture, we implemented the “The What’s Next Intermittent Computing Architecture” paper and we propose two improvements over this architecture which are:
   1. Replacement of a conventional multiplier with an approximate multiplier design and measure the accuracy rates for multiplication results and,
   2. Replacement of conventional memory with a non- volatile memristor based ReRAM.

The motivation behind these two changes is:

1. Multiplication was chosen as the operation to be approximated because of its high frequency of occurrence and high time latency.
2. Memristor was chosen over conventional main memory because of its lower area and power consumption, and higher speed of read/write access.

After referring to several papers, significant ones among those being the following,

1. Intermittent Computing - Challenges and Opportunities