The influence of different structure of components in the computers in an environment with new method

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Abstract—In recent decades despite of improving and developing of the computers they have destroyed environment. Computers have many chips and important components that should be reduced to avoid ruin the environment. As it is clear, Municipal solid waste is a critical environmental risk and a social problem. Presently a high volume of solid waste is being generated every day and unfortunately solid waste management is becoming worse due to the limited resources to handle the increasing rate of generated waste. In this paper we want to propose a method for these components to increase the duration life of these chips to solve this problem. We can use two ways:

a) Change the materials in the factory which is a long term solution.

b) Improve the performance of components to have a longer life. It seems to be a practical solution to have a better environment.

As we know, integrated circuits are mainly made by transistors. We should search for a way to increase the speed of these transistors to increase the life of them. Here we want to introduce methods to obtain this goal. "Residue Number System" and "One-Hot".

The Residue Number System is a non Weighted System. It supports secure arithmetic. "One-Hot Residue Number System" is considered as a method to achieve the best performance. In this implementation the propagation is only equal to one transistor delay.

Keywords- Environment, Municipal, Residue Number System (RNS), One-Hot Residue Number System (OHRNS)

I. INTRODUCTION

A transistor is a semiconductor device which amplify and switch electronic signals. It is made of a solid piece of semiconductor materials, with at least three terminals for connection to an external circuit. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits. Transistors are fundamental building block of the modern electronic devices, and their presence are ubiquitous in the modern electronic systems. As it is been released in the early 1950s the transistor revolutionized the field of electronic, and paved the way to produce smaller and cheaper radios, calculators, and computers, amongst other things. Figure 1 is a simple and basic scheme of a transistor. Figure 2 is an integrated system that is composed of many transistors.

With growing the demand of the world and increasing the variety of electronic devices, these ICs should be developed and become larger. Therefore the number of transistors has been increased. Now we are searching for some methods to have chips with a smaller size and higher speed, because these factors leads ICs to have a longer life and their effects on environment will be postponed.
How can we reach these goals?

For these purposes we suggest the using of Residue Number System (RNS) and One-Hot Residue Number System (OHRNS).

Residue Number System is generally used in those areas where addition, subtraction and multiplication operations of numbers are being repeated. Moreover, since in this system the calculations on the remainders are done independently if one error occurs on one remainder it won’t be transferred to other moduli. In other words, the architecture of RNS is inherently tolerant against faults and error detection and correction are quite possible.

To have best factors in RNS such as having a lower power consumption and so higher calculation speed we can use the One-Hot Residue Number System.

In this paper first we illustrate Residue Number System, after that we demonstrate in One-Hot Residue Number system an overall conclusion will be represented.

II. RESIDUE NUMBER SYSTEM

Residue Number System is unconventional and non-Weighted Number System in which the additions, subtractions and multiplication are inherently carry-free. As a result we may add, subtract and multiply numbers in one step regardless of the length of the number involved [1].

Due to its special features, the Residue Number System has many applications in arithmetic functions such as Digital Signal Processing, Digital Filtering, Coding, RSA ciphering system [2], digital communications, Ad-hoc network, storing and retrieving information [3], Error detection and Correction [4,5], and fault tolerant systems.

This system is generally used in those areas where addition, subtraction and multiplication operations of numbers are being repeated. In the Residue Number System An integer X is represented by an n-tuple \((x_1, x_2, x_3, \ldots, x_n)\) where \(x_i\) is a nonnegative integer satisfy \(X = m_q x_i + r_i\). This causes an increase in calculation speed and a reduction in its power consumption.

Residue Number System is specified by moduli set like \(\{m_1, m_2, m_3, \ldots, m_n\}\) in which all the moduli are positive integers. If all the moduli are relatively pair wise prime the system will have the largest possible dynamic range which equals \(\alpha (\alpha + M)\) in which \(\alpha\) is an integer and M is:

\[
M = \prod_{i=1}^{n} m_i
\]

(1)

The integer \(X\) in \(\alpha <= X <= \alpha + M\) has a single representation in Residue Number System which is shown by the set of remainders \((x_1, x_2, x_3, \ldots, x_n)\). In this way:

\[
x_i = X \mod m_i, i = 1, 2, 3, \ldots, n
\]

(2)

In order to reconstructing the specified number \(X\) the remainders \((x_1, x_2, x_3, \ldots, x_n)\) the Chinese Remainder Theorem is applied as follows:

\[
X = \sum_{i=1}^{n} (x_i/N_i)_{m_i} \times M_i
\]

\[
M = \prod_{i=1}^{n} M_i
\]

\[
M_i = \frac{M}{m_i}, N_i = \{M_i^{-1}\}_{m_i}, i = 1, 2, 3, \ldots, n
\]

(3)

In which \(<M_i^{-1}>\) is defined as multiplicative inverse with moduli.

III. ONE-HOT RESIDUE NUMBER SYSTEM

\(M\), moduli remainders are from zero to \(m_i-1\) that in One-Hot representation a signal line is dedicated for each of these numbers: The activity of each signal shows the similar remainder with it. One-Hot representation for \(m_i\) moduli remainders are shown in figure 3.

- Figure 3 – One-Hot representation for \(m_i\) remainders

In this representation system, in each moment only one of the lines could be active and the remaining lines are inactive. By changing the entrance amount, the amount of two lines changes at maximum level. Therefore the power consumption waste is at minimum level. One-Hot Residue Number System is simple and rapid and has regular and simple structure. In One–Hot representation of remainders, the addition is done by circular shifts. These shifts could be done in several ways and the best one is the Barrel shifter application.

The main and basic element in One-Hot is barrel shifters. In addition to \(m_i\) moduli one of the operands are shifted as the other shifter. In figure 4 this operation is represented for moduli 4 by a graph.

In this graph, one of the two operands is the system condition and the other one is the entry to the system. For example if one of the operands is 2, in the graph we give 2 to it, now the other operand will be as follows:
- If it is zero, then the system will remain in position 2.
- If it is 1, then the system will change to position 3.
- If it is 2, then the system will change to position 0.
- If it is 3, then the system will change to position 1.
In figure 5a, One-Hot addition is represented in which two entries are named as "data entry" and "shift entry" and in figure 5b the total schema is represented.

The shifter transfers the "data entry" to the same extent as "shift entry" and it moves toward output point. The delay of this circuit equals one transistor. In fig. 6, a One-Hot addition is shown for moduli 5 on transistor level and the transistor delay is shown clearly in this figure. The subtraction is the same as addition. The only difference is that "data entry" has a reverse shift equal to "entry shift".

One of the important characteristics of this operation is its independence to the type of moduli \( (2^n, 2^n - 1, 2^n - 1) \), \( (2^n - 1, 2^n, 2^n - 1) \), \( (2^n - 3, 2^n + 1, 2^n - 1, 2^n + 3) \) collections or \( (r^n - 1, r^n, r^n - 2) \), \( (r^n, r^n - 2, r^n + 1) \) moduli collections are selected. The main reason for this selection is the simplicity of its circuit implementation. But in One-Hot, the implementation is totally independent of the moduli type [7-9].

One of the shortcomings of One-Hot System is that it couldn't be implemented for large moduli since the number of transistor are increased. Therefore this system is suitable for small moduli but practically it is not applicable for large moduli.
IV. RESULTS AND DISCUSSION

Municipal solid waste (MSW) is a serious environmental hazard and a social problem [11]. In this paper, we proposed a method to reduce the number of transistors. The result of this paper is directly related to environment, because they are surely irrecoverable blemishes for the natural world and produce toxic materials in the environment. As it is important today, one of the principal factors to avoid air pollution is to suspend particles to come into the environment. Also with Considering the irregular development of cities, improper consumption patterns, increasing production of waste, and deficiencies in waste management systems, the most logical and the least costly method for disposing of municipal wastes [12] is to avoid producing residuals. We can apply these methods for producing all the computers, laptops, and all of the electronic devices to decrease the municipal wastes and sanitary landfill in order to have a healthy environment.

As it was illustrated in the earlier parts, One-Hot Residue Number System is suitable to increase the speed and reduce the number of transistors.

In this article these two techniques are combined.

V. CONCLUSION

Now days, regarding the extension of using of the electronic devices, and specially computers and laptops which are based on transistors, our environment and surrounding conditions are being damaged. One of the most important tasks to do is to optimize the quality and speed of components such as transistors to make them having a longer life. Accurate information of quality and quantity of municipal solid waste is crucial for designing and programming municipal solid waste management system [10].

In this article, the Residue Number System and One-Hot Residue Number System were examined firstly, and after that by combining these Number Systems, we benefit from some advantages such as the simplicity of moduli selection and large dynamic range. One-Hot Residue Number System also has some advantages such as implementation of low-power circuits, the rapidity of calculations, simple and regular structure.

So we subsume that it can be useful to avoid soiling environment and the cost of keeping it clean.

REFERENCES