

Implementation Of Combinational & Sequential Circuit Of Reversible Circuits In Emerging Technologies For HCI

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Abstract:- Affective computing is a growing research area used to develop the system in such a way to recognize, interpret, process and simulate the human emotions in a systematic manner. The main application of Affective computing is the human computer interaction, in which the communication between the human and the machine enhances by giving an appropriate response to the user in an effective and empathic manner. This paper mainly concentrates on the systems which can extract the previous, past and present information based on sequential circuit. To design is BCI control strategies using reversible combinational ckt like multiplexer, multiplier, adder/sub-tractor and sequential circuit for real-time thought control of a human computer interaction (HCI). Design combinational circuit (CC) and sequential circuit (SC) with the help of reversible gate (RG) because RG is an emerging technology and consume low power and area. The CC and SC is implemented Xilinx software and calculates parameters.

Keywords: HCI, BCI, Reversible Gate, Combinational Circuit, Sequential Circuit.

I. INTRODUCTION

The investigation of human PC communication was taken in the mid of 1990s as the World Wide Web, email, and Windows 95 burst upon the scene. The Dix says "human PC cooperation is the investigation of individuals, PC innovation and the ways these impact each other[1]. Concurring the Carroll, "human PC association is the examination and practice of ease of use. It is tied in with comprehension and making programming and other innovation that individuals will need to utilize and will discover viable when utilized. Human PC communication now and then known as man-machine association, this idea was naturally spoken to with the developing innovation of PC, to make the human amicable, increasingly intuitive and proficient workplace with the machine. The idea of human PC communication additionally says that how human associates with the PC: not fundamentally the investigation of human, not basically the investigation of PC, it is the extension between them, which incorporates perception of communications among individuals and PCs. The explanation, actually, is clear most complex machines are useless except if they can be utilized appropriately by men. This idea thinks about numerous parts of human practices and should be valuable. In this way, in structure of human

PC connection, the level of movement that includes a client with a machine ought to be altogether thought. The client movement has three unique levels; physical, psychological, and full of feeling. The physical angle decides the mechanics of collaboration between human what's more, PC while the psychological angle manages ways that clients can comprehend the framework and connect with it[2]. The full of feeling angle is a later issue and it attempts not just to make the connection a pleasurable encounter for the client yet in addition

to influence the client such that make client keep on utilizing the machine by changing dispositions and feelings toward the client.

The capacity to convey and collaborate with machines utilizing thought has caught the creative mind of humankind over numerous ages. Ongoing progresses in intellectual neuroscience and mind mapping innovations enable us to interface straightforwardly with the human cerebrum. Using sensors one can screen the physical procedures happening inside the mind that relates to a certain type of considerations [3]. At first, scientists utilized these advances to construct braincomputer interfaces (BCIs) [4] to give restoration to individual's physical incapacities and improve their way of life. BCIs give a correspondence channel that doesn't depend on the cerebrum's typical practical pathways of fringe nerves and muscles. Here, the clients expressly control their mind movement to control an outside gadget like a PC or a prosthetic arm. Such innovations give another rent of life to individuals experiencing obliterating neuromuscular wounds and neurodegenerative infections, for example, amyotrophic parallel sclerosis, loss of motion, cerebral paralysis and amputees [5]. As of late, the field of utilization of BCIs began including PC gaming [6], correspondence [7], robot control in mechanical and military applications. Scientists taking a shot at human computerinterface (HCI), consistently endeavors to increment the correspondence data transfer capacity and quality between the connections happening between the human and the PC (or robot).

These scientists investigate the different perceptions also, multimodal showings with the goal that PCs may use however many tactile channels as could be expected under the circumstances to send information to a human. Likewise, they have structured and created equipment and programming advancements to build the information stream to the PC in the most limited conceivable time. Also, these analysts are endeavoring to find data about client state and purpose by noticing their physiology, conduct and their working condition. Such data helps the framework to powerfully adjust and give better help to the client for the main job [8]. BCI specialists extraordinarily advantage from the expertise created in the field of HCI where the frameworks depend entirely on interfacing with the cerebrum as the control component. In like manner, BCIs are currently settled enough with the end goal that HCI scientists may incorporate them while structuring novel input methods (particularly in conditions with requirements on ordinary engine development), while estimating generally slippery subjective or passionate wonders in assessing our interfaces, or then again while attempting to construe client state to assemble versatile frameworks [7].

II. HUMAN-COMPUTER INTERACTION

The development in Human-Computer Interaction (HCI) field has not exclusively been in nature of association, it has likewise experienced diverse expanding in its history. There have been different PC driven transformations before. It might incorporate the PCs from 1960 to 2000. A diagrammatic portrayal is as appeared in Figure 1. In 1960s one centralized computer was utilized by numerous clients. In any case, the circumstance changes in 1980s. Work area PCs are generally utilized by the clients for various reason like charging in shops, keeping records, and so forth. In 2000 a solitary client is associated with various PCs for doing their work. Presently versatility is happened in 2000 and client can do his work from wherever. Be that as it may, we are looking sooner rather than later for example is in 2020. It might resemble the fourth picture as appeared in Figure 1. We are expecting such a change in HCI [8].

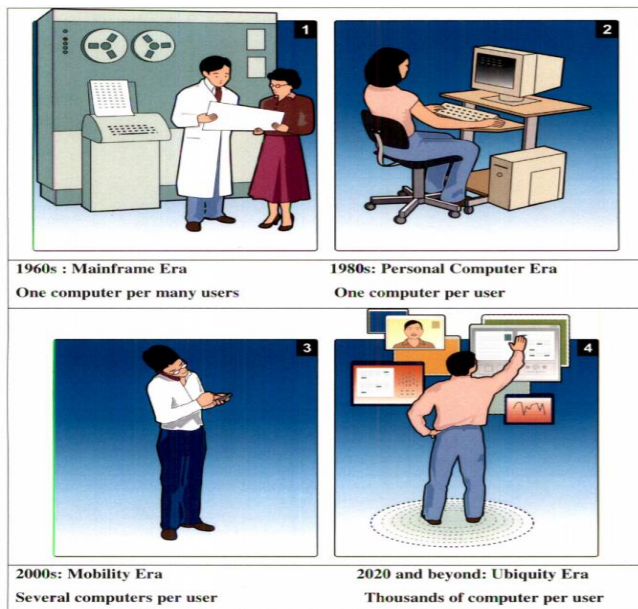


Figure 1: Illustration of Changes in HCI from 1960s to 2000 and expecting 2020 being as vivid as 4th image

Toward the beginning of the 21st century, HCI was an interdisciplinary field which has experienced huge changes. Regarding a science or a control, these progressions have happened over a brief span. HCI now envelops numerous ways of thinking, points of view what's more, kinds of mastery. There are various and covering gatherings of analysts, some underscoring structure, others assessing, but then others client displaying. These specialists all work inside a mind boggling space, each inspecting various parts of human-PC collaboration. Various strategies are utilized, contingent upon various objectives [9].

Most important factor of a HCI design is its configuration. In fact, any given interface is generally defined by the number and diversity of inputs and outputs it provides. Architecture of a HCI system shows what these inputs and outputs are and how they work together. Following sections explain different configurations and designs upon which an interface is based.

- A. Unimodal HCI systems
- B. Multimodal HCI system

Unimodal HCI systems: - As mentioned earlier, an interface mainly relies on number and diversity of its inputs and outputs which are communication channels that enable users to interact with computer via this interface. Each of the different independent single channels is called a modality. A system that is based on only one modality is called unimodal. Based on the nature of different modalities, they can be divided into three categories [10, 11]:

Visual-based: The visual based human computer interaction is probably the most widespread area in HCI research. Considering the extent of applications and variety of open problems and approaches researchers tried to tackle different aspects of human responses which can be recognized as a visual signal. Some to the main research areas in this section are as follow:

- Facial Expression Analysis
- Body Movement Tracking (Large-scale)
- Gesture Recognition

- Gaze Detection (Eyes Movement Tracking)



Figure 2: The Readable: a multitouch interface for playing music

Audio-based: The audio based interaction between a computer and a human is another important area of HCI systems. This area deals with information acquired by different audio signals. While the nature of audio signals may not be as variable as visual signals but the information gathered from audio signals can be more trustable, helpful, and in some cases unique providers of information. Research areas in this section can be divided to the following parts:

- Speech recognition
- Speaker recognition
- Auditory emotion analysis
- Human-made noise/sign detections (gasp, sigh, laugh, cry, etc.)
- Musical interaction



Figure 3: Speaker recognition

Sensor-based: This section is a combination of variety of areas with a wide range of applications. The commonality of these different areas is that at least one physical sensor is used between user and machine to provide the interaction. These sensors as shown below can be very primitive or very sophisticated [12].

- Pen-based interaction
- Mouse & Keyboard

- Joysticks
- Motion tracking sensors and digitizers
- Pressure sensors
- Taste/smell sensors

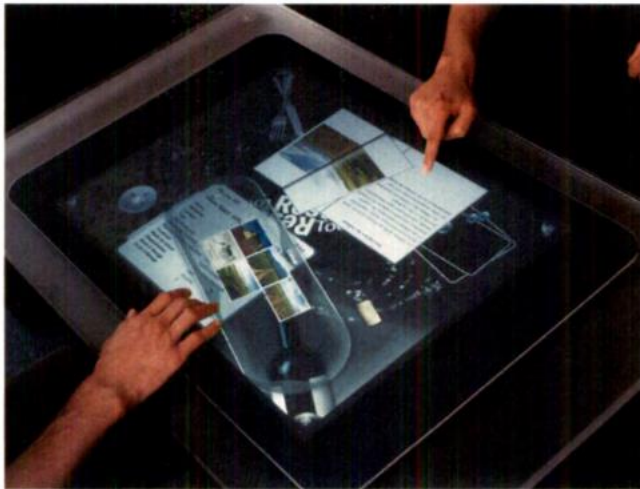


Figure 4: Microsoft's 'Surface

Multimodal HCI systems: - The term multimodal refers to combination of multiple modalities. In MMHCI systems, these modalities mostly refer to the ways that the system responds to the inputs, i.e. communication channels. The definition of these channels is inherited from human types of communication which are basically his senses: sight, hearing, touch, smell, and taste. The possibilities for interaction with a machine include but are not limited to these types. A multimodal interface acts as a facilitator of human-computer interaction via two or more modes of input that go beyond the traditional keyboard and mouse. The exact number of supported input modes, their types and the way in which they work together may vary widely from one multimodal system to another [13, 14].

III.METHODOLOGY

Central Processing Unit (CPU) concept of reversible architecture involves in an attempt to reduce the execution time. Type of microprocessor used for CPU is mostly Reduced Instruction Set Computers nowadays since they can execute instruction very fast because the instructions are so simple. Reversible CPU consisting of various components includes are as follows: Control Unit (CU), Arithmetic and Logical Unit (ALU), Register files and other important components such as Accumulator, Temporary Register, ALU Result Register, Status Register, program Counter, Instruction Register etc. And the functional units like Main memory, Buses, and I/O. The data path and control unit perform the actual processing task using ALU. Control unit directs the operation within the processor based on the signal received from data path by directing I/O of the system. These signals control the data flow between the CPU and main memory and I/O. The most important feature of reversible CPU is to decode the information. Control unit retrieves the instruction from memory and carries out a sequence of operation required for ALU. It also fetches the instructions from the instruction registers, where an input to control logic comes from a reversible decoder. The decoder is the important block of a control unit which provides the information means an ability to execute one instruction per cycle. ALU is used to perform the arithmetic and logical operations of CPU on data contained in different

registers. Each operation is carried out in sequence. Reversible ALU contains submodules like the reversible adder, subtractor, multiplier etc., using reversible gates. Elements in ALU is implemented in a reversible manner with low power using VHDL (VHSIC-Hardware description Language) to reduce execution time. Basically, signals are communicated through memory unit [15].

Harvard architecture is used instead of Von Neumann, i.e program and data are accessed on separate buses as shown in the Figure 5. The main advantage of using Harvard architecture is that address and data buses are separate, so single clock cycle can perform both read and write operations. The memory access is done directly as well indirectly.

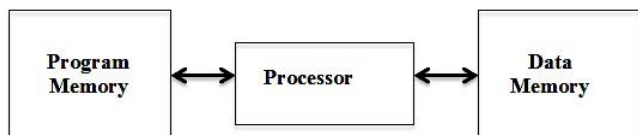


Figure 5: General Structure of Hardware Architecture

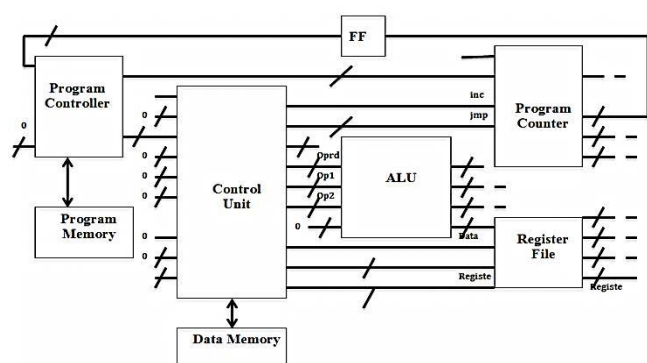


Figure 6: A Review Block Diagram, Which We Have to Improve

RAS: - RAS is depending on number of bits. 2-bit addition is used to Peres gate (PG) and 3-bit addition is used to double Peres gate (DPG). Structure for 3-bit addition is shown figure 7.

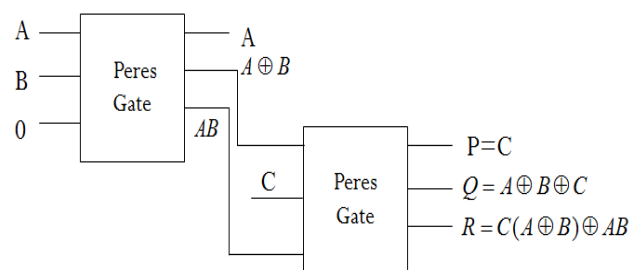


Figure 7: Structure of DPG

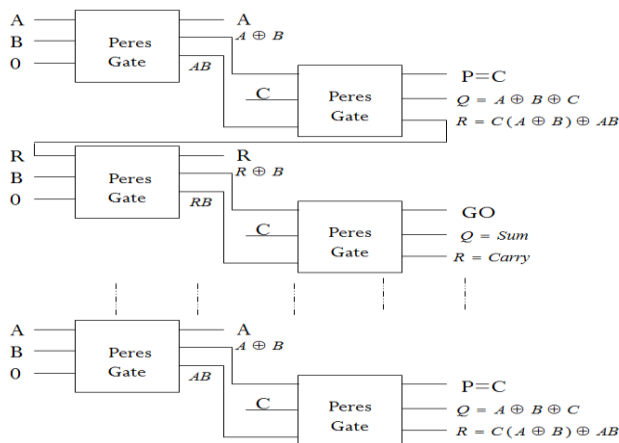


Figure 8: Structure of N-bit DPG

DPG is used to three inputs A, B and C and three output P, Q and R. $P=C$ is the garbage output of DPG because 3-bit addition only two output i.e. 'SUM' and 'CARRY'. 'SUM' is represented by Q and 'CARRY' is represented by R.

Structure of N-bit DPG is shown figure 8. In N-bit structure, first DPG 'CARRY' is connected to second DPG input. In this paper 4-bit adder is implemented then four DPG are used.

RM:-

RM is based on two concepts, first one is generation of all partial products (PP) of multiplication in parallel using TG and then secondary these terms are added together using multi operand addition (MOA) algorithm using DPG and PG.

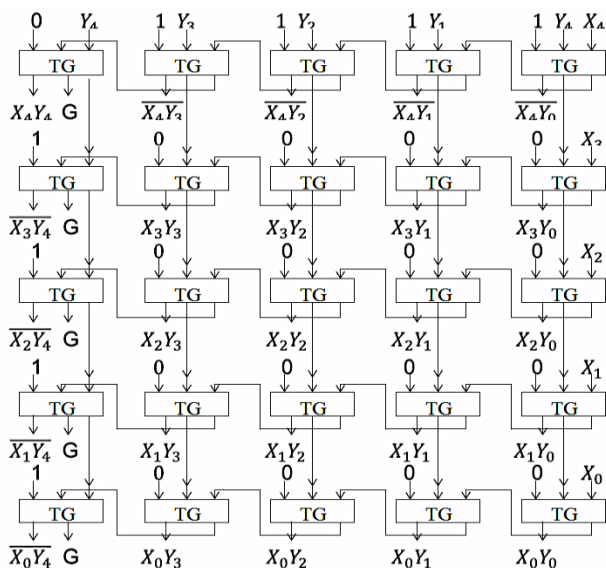


Figure 9: PP of RM

Once PP terms are generated, the following step is the MOA to adding the bits of each column. This can be done by using DPG and the PG shown figure 10.

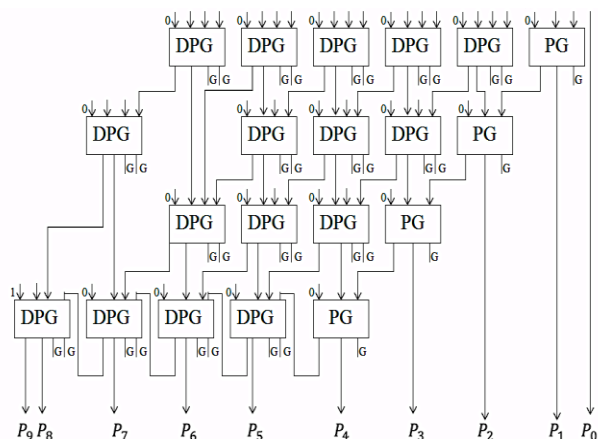


Figure 10: MOA for RM

RMUX:-

The main use of multiplexer is for data selection, translation of parallel data into serial one. Circuit implementation for the 4x1 RMUX is shown in Figure 11 is done in a reversible manner by using reversible logic R gate.

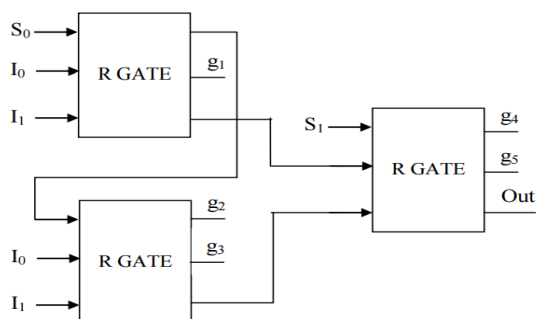


Figure 11: Structure of 4x1 RMUX

IV. SIMULATION RESULT

More in particular, we have grown new rubbish free circuits for expansion and are working towards a general duplication circuit. We have likewise consolidated various tasks together to execute a reversible number-crunching rationale unit. With these and other waste free number-crunching circuits it is conceivable to outline bigger reversible processing frameworks. For instance, we have executed discrete lossless changes by updating these with a lifting plan. We have additionally demonstrated the outline of a reversible figuring engineering and executed this utilizing just reversible rationale doors. While, these are still little frameworks, with assist improvement it ought to be conceivable to utilize comparable methodologies to execute considerably bigger frameworks.

Table 1: Compare Result

Reversible Designs		Quantum Cost	Garbage Output	Constant Input
Reversible Multiplexer	Existing	15	5	0
	Proposed	12	5	0
	Existing	15	2	3

Reversible DEMUX	Proposed	12	2	3
Reversible Decoder	Existing	27	1	6
	Proposed	23	1	6
Reversible Encoder	Existing	27	9	4
	Proposed	22	9	4
Reversible Multiplier	Existing	341	61	46
	Proposed	237	46	46
Reversible Adder/ Sub-tractor	Existing	36	9	5
	Proposed	30	10	5

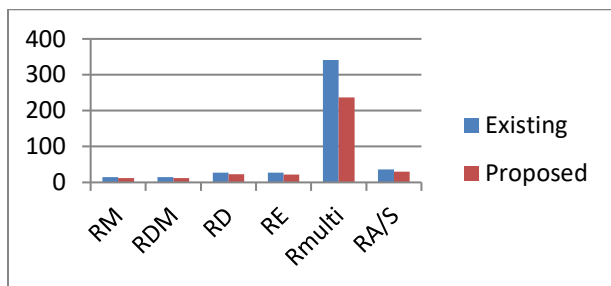


Figure 12: Bar Graph of Quantum Cost

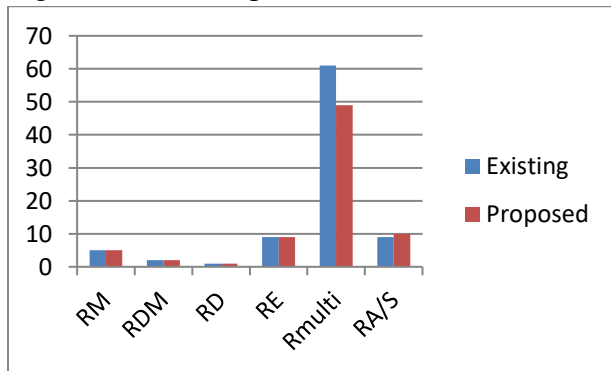


Figure 13: Bar Graph of Garbage Output

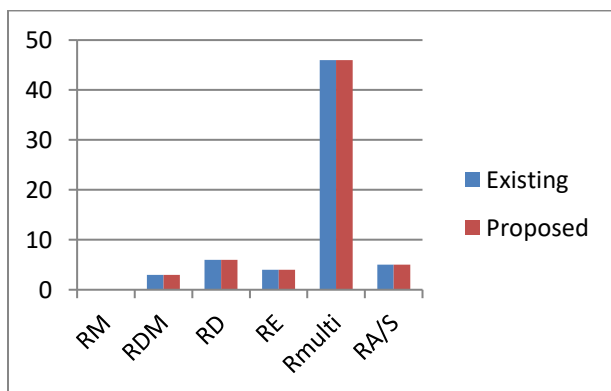


Figure 14: Bar Graph of Constant Input

Table II: Comparative Study of Various Parameters for Reversible Memory Element

Parameters	Quantum Cost	Garbage Output	Constant Input	Delay	Gate Count	Total Cost
Existing design	48	4	4	4	48	100
Proposed	44	4	4	4	44	92

V. CONCLUSION

Proposed a combinational and sequential element with the improved performance in terms of design parameters improves the execution time of overall architecture is present. Proposed designs are compared in terms of cost, garbage output, constant input, delay, gate count, power, area and a total cost to the existing design. Proposed multiplexer improve the instruction fetch unit performance and instruction decode unit. Logic style use is reversible in nature provide the regularity for implementation using random and proposed logic design gives out efficient design implementation which improves the performance of overall architecture and increases its speed.

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