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# Study of mathematics through indian veda's : A review

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**Abstract.** Vedic Mathematics a method of conceptual calculation also reasoning. It has 16 sutras (formulas) and 13 sub-sutras(corollary). Vedic Mathematics formulas, which are mathematical concepts founded proceeding antediluvian Indian scripts called Veda meaning, knowledge reiterated by SWAMI SRI BHARATI KRISNA TIRTHAJI MAHARAJA. Due to its versatile nature and speed, it applies to many fields. This paper is an array of growth and development in the field of Vedic mathematics with a special focus on the structure of Vedic multipliers and Vedic algorithms like Urdhva Tiriyagbhyam and Nikhilam algorithms. Further an over view of Vedic Mathematics with NEP2020 is deliberated.

## 1.INTRODUCTION

Vedic Mathematics introduced as primeval technique of Mathematics, which was reminisced, as of the Vedas in the middle of 1911 and 1918 by Sri Bharati Krishna Tirthaji (Ifrah. G, 1998). Conferring toward his study, completely mathematics originated on sixteen Sutras or word-formulae. Vedic Mathematics is a pool of primeval wiles and methods to perform arithmetic operations swiftly and more proficiently known as Indian Mathematics named as "Vedic Mathematics" since its source out of Vedas. Specifically created commencing "Atharva Vedas" the 4th Veda. "Atharva Veda" compacts with the divisions like Engineering, Mathematics, sculpture, Medicine, also form of sciences, as we know today. Veda origins from Sanskrit term refers to 'Knowledge'. Imparting systematic mathematical footsteps, deciphering difficulties at times, which is intricate and arduous. Nevertheless, using Vedic Mathematics for Common Techniques (pertinent completely collections of certain information) and Unambiguous Methods (germane ref to unambiguous collections of particular information), numerical calculations can be completed very debauched. [1][2] Vedic Mathematics offers the solution in one line although the unadventurous technique needs numerous steps. It is an primeval method, which abridges complex numbers, squaring, multiplication, cubing, divisibility, square, and cube roots. Vedic Mathematics be able to handle even repetitive auxiliary fractions and decimals. The easiness of the Tirathji method revenues calculations is passed rationally, nevertheless. Procedures able to written down. Here are numerous profits of using a malleable, rational method. Learners able to frame own approaches; and stay imperfect to single manner. It centrals to additional inventive, engrossed, and smart learners. Problematic arithmetic complications and enormous sums can often be deciphered instantly by Tirthaji's approaches. These prominent and stunning approaches stand a share of a structure of arithmetic, which Tirthaji claims to be far more methodical than the recent method. "Vedic" Mathematics is assumed to apparent to lucid also amalgamated structure of arithmetic and its approaches remain harmonizing, undeviating, also laid-back.[3][4] This paper consists of 5 sections; section 1 explains the origin of Vedic Mathematic; section 2 discusses about the founder of Vedic Mathematics; section 3 explains about Vedic Sutras and Sub-Sutras; Section 4 discusses about the growth in the field of Vedic Mathematics which



includes various previous works and the proposed work ; section 5 discusses about the Vedic Multiplier based on Urdhva Tiryakbhyam Sutra and Nikhilam Sutra ; section 6 concludes the paper.

## 2.ABOUT THE FOUNDER OF VEDIC MATHEMATICS

Vedic Mathematics is a method of mathematics, revealed by Indian mathematician **Jagadguru Shri Bharathi Krishna Tirthaji** in the dated in the middle of A.D. 1911 and 1918 and published his discoveries in a Vedic Mathematics Book by Tirthaji Maharaj. **Shri Bharathi Krishna Tirthaji Maharaj** was born in March 1884 in the Puri village of Orissa state. He was brilliant in subjects like mathematics, science, humanities and was outstanding in the Sanskrit language. His interests were also in spiritualism and meditation. When he was committed in meditation in the forest near Sringeri, he revived the Vedic sutras. He claims that these sutras or methods he erudite from the Vedas specifically 'Rig-Veda' unswervingly or meanderingly and he spontaneously revived them had performed meditation for 8 years. Far along, he put pen to paper the sutras on the scripts but were lost. Lastly, in the year 1957, he wrote an preliminary volume of 16 sutras, which is called Vedic Mathematics, and deliberate to transcribe other sutras later. Soon he industrialized a flume in both of his eyes and passed away in the year 1960. [5]

## 3.ABOUT VEDIC SUTRA'S

Vedic sutras second hand successfully for resolving factorization, HCF, divisions, squares, reciprocals, and square roots, cubes and cube roots, algebraic equations, quadratic equations, multiple simultaneous equations, biquadratic equations, , cubic equations, higher degree equations, Partial fractions, Integrations, , differential calculus, Pythagoras theorem, Apollonius Theorem, Analytical Conics and so on.[6]

### 3.1 Various Vedic Sutras are—

- a) Urdhva-Tiryagbhyam : Perpendicularly and crossway
- b) Nikhilam Navatashcaramam Dashatah : all from 9 and the last from 10
- c) Ekadhikena Purvena : By one more than the previous one
- d) Paravartya Yojayet : Transfer and amend
- e) Shunyam Saamyasamuccaye : When the entirety is the similar that totality is zero
- f) Anurupye Shunyamanyat : If one is in relation, the other is zero
- g) Sankalana-vyavakalanabhyam : By adding and by deduction
- h) Puranapuranaabyham : By the conclusion or non-completion
- i) Chalana-Kalanabyham : Alterations and Resemblances
- j) Yavadunam : Whatever the magnitude of its insufficiency
- k) Vyashtisamasthi : Share and Entire
- l) Shesanyankena Charamena : The remnants by the last digit
- m) Sopaantyadvayamantyam : The eventual and double the last but one
- n) Ekanyunena Purvena : By one fewer than the preceding one.
- o) Gunitasamuchyah : The product of the entirety is equivalent to the entirety of the product.
- p) Gunakasamuchyah : The influences of the entirety are equivalent to the entirety of the factors.

### 3.2 Various Vedic Sub-Sutras are—

- a) Adyamadyenantyamantyena
- b) Seagate Sesamjnah
- c) Anurupyena
- d) Kevalaih Saptakam Gunyat
- e) Vestanam

- f) Shunya Anyat
- g) Yavadunam Tavadunikritya Varga Yojayet
- h) Antyayordashake'pi
- i) Samuccayagunitah
- j) Lopanasthapanabhyam
- k) Vilokanam
- l) Gunitasamuccayah
- m) Dhvajanka
- n) Dwandwa Yoga
- o) Adyam Anya Madhyam

## 4.GROWTH OF VEDIC MATHEMATICS

### 4.1 Previous Work

In the year 2005 Himanshu Thapliyal and M.B Srinivas have spoken the key laborious processes in Elliptic Curve Encryption- such as point addition and doubling- by using ancient Vedic mathematics and have derive up with an well-organized elucidation for the same. [7] In the year 2009 Ramalatha, Dharani, et al., has spoken the computational difficulties in the cubing circuits by expending “Anurupya” Vedic Sutra as a key. The model outcomes demonstration that there is an huge progress in circuit recital with the use of Vedic ideologies. [8] In the year 2010 since plummeting the calculation, time in conformist Fourier Transforms -which discovers vast solicitations in the meadow of digital signal processing - the FFT algorithm were familiarized. Anvesh Kumar, Ashish Raman, et al., in his paper, have advance abridged the hardware complication in applying the FFT algorithm by accepting Vedic Mathematics, which lead to ominously dipping the number of adders and multipliers.[9] In the year 2012 Jubin Hazra has validated the usage of Vedic mathematics in the application of circular obscurity circuits and has attained about 74-97% enhancement in terms of Power-Delay-Product (PDP) as equated with the conventional circuit. In addition, Diganta Sengupta, Mahamuda Sultana, et al., have comprehensively related the speed of conformist Non-Restore type division algorithm with the Vedic division algorithm, which uses “Urdhava Trigyaagbhyam” Sutra and “Nikhilam” Sutra, on the low-end processors. Their outcomes display that the conventional division takes 49.3  $\mu$ s to compute the division of a 15 digit dividend, while the Vedic division does the same in 2.3 $\mu$ s thereby accumulative the speed by multifold! [10] In the year 2014 Shantanu Oke, Suraj Lallu, and Prathamesh Lad have prepared a relative study in the conniving of VLSI-based Distinctive Divider. SRT division, ‘Newton Raphson’ method, and ‘Dhwajam’ Sutra methods are equated and considered. The outcomes designate that the Vedic philosophies are the laidback explanations to multifaceted divisions and make the most of the system performance. In addition , a project by Anjana R, Abishna B, et al., (2014) displays the application of the Vedic multiplier by the Kogge-Stone adder. Their model outcomes authenticate that their design is the fastest multiplier and adder of the time also added misusing the benefits of Vedic mathematics. In addition Panwit Tuwanuti and Nopphagaw Thongbai have prolonged their use in multicore processors. It deals with the divide and conquers method, in which long multiplier digits are split into sub-blocks, these sub-blocks are instantaneously multiplied in diverse cores using Vedic Sutras and the outcome is gained by the concatenation of all the product terms. This technique swiftly computes the multiplication of long numbers. In view of highlighting the need for data security in communication, M Senthil Kumar and S Rajalakshmi have decorated the usage of Vedic mathematics in designing an optimal architecture for achieving mix columns process, which is an significant stage in the Advanced Encryption Principles of Cryptography. Their design evidences to be far more real than the conservative architecture. In addition, S Hemalatha and V Rajamani have validated the usage of Vedic mathematics in the design of wireless sensor networks (WSN). They defines how the usage of Vedic principles magnificently produces highly economical and improved information security systems as related with the old technique.[11] In the year 2015 Khurajam Nelson Singh and H. Tarunkumar had read the

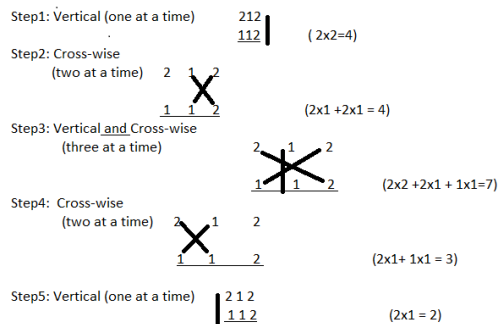
numerous multiplier designs in VLSI. From their study, it is unblemished that the Vedic multiplier leave behind several other multipliers such as array multiplier, Wallace multiplier, Bypassing Multiplier, and Booth multiplier in numerous facets. In addition, SV Mogre and DG Bhalke have suggested the application of high-speed matrix multiplication on FPGA using the “Urdhava Trigyagbhyam” Sutra. This design indicated the important drop in Area/Speed Ratio, surges the running frequency of the multiplier, and makes the system energy efficient. Further, Aditi Tadas and Dinesh Rotate (2015. pp.317-320) have agreed a relative study of Nikhilam, Dhvajank, and Paravartya Sutras in designing a 64 Bit Divider and have examined the influence of these three Sutras in contradiction of the aspects which agree the show of the processor such as consumption of power, hardware difficulties, space application, and Speed. they have anticipated a new algorithm using Vedic ideologies, which is future more proficient and efficient as associated to the three Sutras. Later, Kunal Jadhav, Aditya Vibhute, et al., have proposed Vedic ideologies as a key to upsurge the speed of the Arithmetic Logic Unit (ALU), which was intended by employing reversibility in the circuits, to reduce power degeneracy at the cost of abridged speed. Thus imminent with power-proficient and more rapidly ALU. In the area of stirred by the working of the human brain, Anshika, Yamuna, et al., have premeditated a Vedic neuron, using the “Urdhava Trigyagbhyam” Sutra, which outpaces the typical neurons in relations of speed and energy effectiveness. The use of Vedic neurons in Artificial Neural Networks is also been presented.[12][13] In the year 2016 Anuradha Savadi and Raju Yamanshetti analyses the design of digital signal processors. It discourses the diverse algorithms used for designing high-speed DSP processors. After a complete analysis of about thirteen papers, they decided that the multiplier was designed using “Urdhava Trigyagbhyam” Sutra, and binary dividers applied using “Nikhilam navatascaramam Dasatah” and “Paravartya” sutra are more in terms of speed, area, difficulty as associated to the current approaches. Further, A study by Lavanya M and Kalaiselvi A, demonstrates the usage of Vedic ideologies in designing an Adaptive FIR filter which is used in RADAR for detecting weak RADAR signals.[14] In view of the NEP 2020, research stressed on Vedic mathematics, which is demonstrate its values. While deviousness can be swift and precise in mathematical study, it will be supportive, tortuously, for other natural sciences as well as social sciences. Specialists of Vedic mathematics say that its exercise impressively develops reasoning, analysis, and synthesis capacity, which are vital for study. Though, here are defies in learning/ teaching Vedic mathematics. Specially in the age of online learning, diverse apps or resources has to be primed. An additional challenge would be to formulate course materials/books for the undergraduate. One of the objectives of the NEP is to reinstate and re-inaugurate ‘Indian-ness. Vedic mathematics can demonstrate to be an significant tool in this ‘reawakening of India (Bharat)’.

#### 4.2 Proposed work

For ingenuous high speed multipliers, the Vedic Multipliers (VMs) are selected. These multipliers offer high speed of process though they are area proficient too. The Vedic Multiplier has an irregular erection hence can be effortlessly layout in a Silicon chip. Vedic multiplier can be used for numerous usage. Since multiplication is the most essential process in numerous DSPs for execution processes like complexity, filtering, Fast Fourier Alters and in the ALU units, the Vedic Multipliers is established to be taking more speed than additional multipliers. This is due to the limited products are produced and summed up parallel. In addition, the deferral related with the Vedic Multipliers is mostly due to the breeding of carry bits through adders. In this paper Vedic multiplier is based on the Vedic Sutra’s like URDHAVA and NIKHILAM :

##### 4.2.1 *UrdhvaTiryagBhyam* - vertically and crosswise.

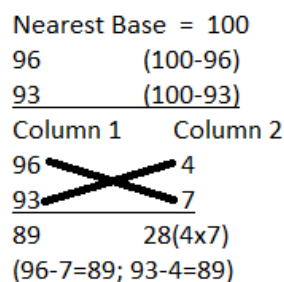
Ex.1. The product of 212 and 112 using above sutra is given below:



RESULT:  $212 \times 112 = 23744$

#### 4.2.2 Nikhilam navatashcharamam Dashatah - All from nine and last from ten.

Ex.2. The product of 96 and 93 using above sutra is given below:



RESULT:  $96 \times 93 = 8928$

## 5. VEDIC MULTIPLIER'S

5.1 Vedic Multiplier discussed in this context is based on Urdhva Tiryakbhyam Sutra:

(literally- "Vertically and Crosswise"). Using this sutra the partial products are generated and added together. This multiplier design has the advantage that as the number of bits increases, the gate delay and area increases slowly. Therefore it is time, space and area efficient. Initially the two×two Vedic Multiplier is applied with 4 AND gates and 2- 1/2 adders. By with this sutra, the superior number (N×N) is fragmented downcast addicted to smaller numbers (N/2×N/2) and this lesser numbers are again fragmented into still reduced numbers (N/4×N/4) till we grasp multiplicand of size two×two, thus abridging the entire multiplication procedure. Hence four× four Vedic Multiplier is implemented using four two×two Vedic Multipliers and three four -bit adders. Also an eight× eight Vedic Multiplier is implemented using four four×four Vedic Multipliers and three eight-bit adders. Thus an N×N Vedic Multiplier is implemented using four (N/2×N/2) Vedic Multipliers and three N-bit adders.[15][16][17][21][22][23][24][25]

The two x two Vedic multiplier segment is applied with 4 input AND gates and two half-adders which is showed in its block diagram (Fig.1)

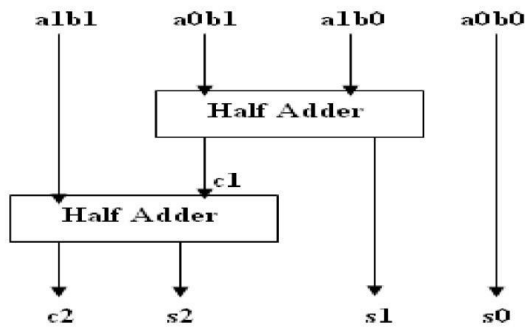


Fig.1

The 4x4 bit Vedic multiplier segment is applied using four two x two bit Vedic multiplier modules and three four-bit calculators as deliberated in Fig.3

Mockup Demonstration for four x four bit Vedic Multiplication

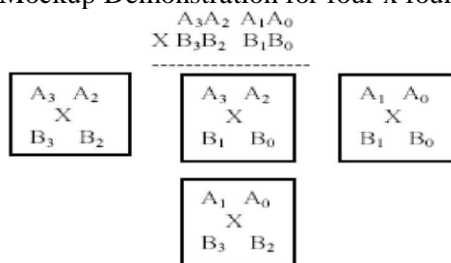


Fig.2

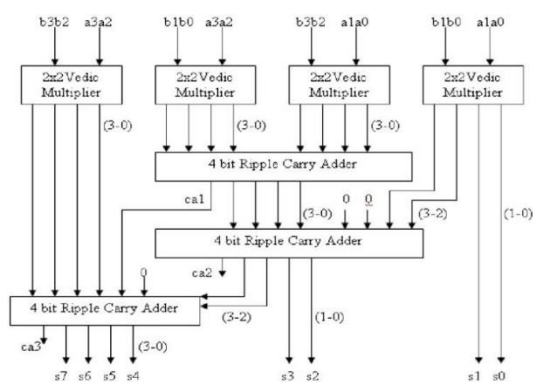


Fig.3

The eight  $\times$  eight bit Vedic multiplier module is applied using four 4x4 bit Vedic multiplier modules and three eight-bit adders as discussed in Fig.4

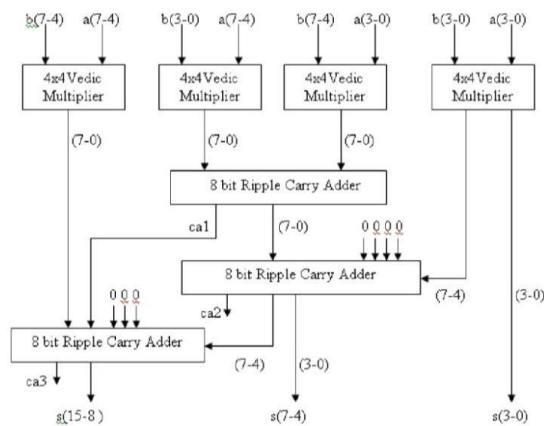


Fig.4

Indiscriminate Algorithm for  $N \times N$  bit Vedic Multiplier : For  $AXB$ , the general representation for Vedic multiplication is discussed in figure 5. [18][19]



Fig.5

5.2 Vedic Multiplier discussed in this context is based on Nikhilam Sutra:

Nikhilam sutra cast-off to convert large- figure multiplication to small figure multiplication by application of following operations like subtract, add, and shift operation. A high speed multiplier can be designed by using this sutra. Also efficiently works for binary number system. It is relevant to multiplication of bases like 10, 100, 1000. The block diagram of Vedic multiplier using this sutra is shown in Fig.6 , this structure is for two inputs multiplication of 8-bit multiplier and 8-bit multiplicand operand. [20]

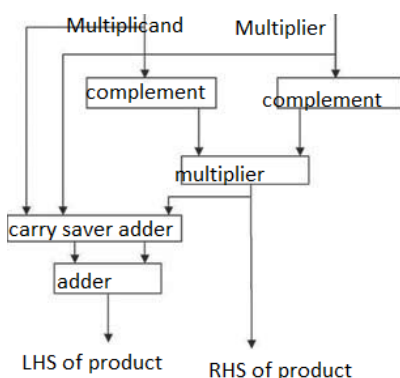


Fig.6

## 6. CONCLUSION

In this review paper we have discussed the advantages and fast growth of Vedic Mathematics. Since this gives faster calculation in multiplication, division, squaring, cubing etc. Therefore has widely applicable in designing Vedic Multipliers. This gives faster and better results than other multipliers. This creates a very good base for additional thinking and origination and has a huge influence on education. In view of new scheme of education NEP 2020 policy, more focus is given to Vedic Mathematics starting from primary and secondary level of education to the higher education.

## 7. REFERENCES

- [1] Sri BharatiKrsnaTirthaji, "Vedic Mathematics", published by Motilal Banarsidass, 1965. ISBN 81- 208-0163-6.
- [2] Williams K.R. "Discover Vedic Mathematics." Vedic Mathematics Research Group, 1984. ISBN 1- 869932-01-3
- [3] Williams K.R. and M. Gaskell "The Cosmic Calculator". Motilal Banarsidass, 2002.ISBN 81- 208- 1871-7.
- [4] Nicholas A.P., Williams, J. Pickles. "Vertically and Crosswise". Inspiration Books, 1984. ISBN 1- 902517-03-2.
- [5] Agrawala, V. S. (1971). Vedic Mathematics. Delhi: Motilal Banarsidas. Ancient Multiplication Methods. (n.d.). Retrieved February 17, 2010,
- [6] Bibhutibhushan, D., & Avadesh, N. S. (2001). History of Hindhu Mathematics. Delhi: Bharatiya Kala Prakashan
- [7] Himanshu Thapliyal, M.B Srinivas, "*An Efficient Method of Elliptic Curve Encryption Using Ancient Indian Vedic Mathematics*", IEEE 2005, pp.826-828.
- [8] Ramalatha M, Thanushkodi K, Deena Dayalan K, Dharani P, "*A Novel Time and Energy Efficient Cubing Circuit using Vedic Mathematics for Finite Field Arithmetic*", International Conference on Advances in Recent Technologies in Communication and Computing (2009).
- [9] Anvesh Kumar, Ashish Raman, Dr.R.K.Sarin, Dr.Arun Khosla, "*Small area Reconfigurable FFT Design by Vedic Mathematics*", IEEE 2010, vol. 5, pp. 836-838.
- [10] Jubin Hazra, "*An Efficient Design Technique of Circular Convolution Circuit using Vedic Mathematics and McCMOS Technique*", International Conference on Computer Communication and Informatics (ICCCI -2012).
- [11] Shantanu Oke, Suraj Lulla, Prathamesh Lad, "*VLSI (FPGA) Design for Distinctive Division Architecture using the Vedic Sutra 'Dhwajam'*", 2nd IEEE International Conference on Devices, Circuits, and Systems (ICDCS), (2014).
- [12] Kunal Jadhav, Aditya Vibhute, Shyam Iyer, R. Dhanabal, "*Novel Vedic Mathematics Based ALU Using Application-Specific Reversibility*", IEEE Sponsored 9th International Conference on Intelligent Systems and Control (ISCO), (2015).
- [13] Anshika, Yamuna SV, Nidhi Goel, S.Indu, "*Neuronal Logic Gates Realization using Vedic Mathematics*", 1st International Conference on Next Generation Computing Technologies (NGCT-2015), pp.450-455.
- [14] Anuradha Savadi, Raju Yanamshetti, "*A Survey on Design of Digital Signal Processor*", IEEE WiSPNET 2016 conference, pp. 2483 -2486, (2016).
- [15] Honey Durga Tiwari, Ganzorig Gankhuyag, Chan Mo Kim and Yong Beom Cho, "Multiplier design based on ancient Indian Vedic Mathematician", International SoC Design Conference, pp. 65- 68, 2008.
- [16] Parth Mehta and Dhanashri Gawali, "Conventional versus Vedic mathematics method for Hardware implementation of a multiplier", International conference on Advances in

- Computing, Control, and Telecommunication Technologies, pp. 640-642, 2009.
- [17] H. Thapliyal and H.R Arbania. "A Time-Area-Power Efficient Multiplier and Square Architecture Based On Ancient Indian Vedic Mathematics", Proceedings of the 2004 International Conference on VLSI (VLSI'04), Las Vegas, Nevada, June 2004, pp. 434-439.
  - [18] P. D. Chidgupkar and M. T. Karad, "The Implementation of Vedic Algorithms in Digital Signal Processing", Global J. of Engg. Edu, Vol.8, No.2, 2004, UICEE Published in Australia.
  - [19] Ch Harish Kumar. Implementation and Analysis of Power, Area and Delay of Array, Urdhva, Nikhilam Vedic Multipliers, *I. J. of Scientific and Research Publications*, Jan 2013
  - [20] Manoranjan Pradhan & Rutuparna Panda (2014) High speed multiplier using Nikhilam Sutra algorithm of Vedic mathematics, International Journal of Electronics, 101:3,300-307, DOI: [10.1080/00207217.2013.780298](https://doi.org/10.1080/00207217.2013.780298)
  - [21] Anjana, S., C. Pradeep, and Philip Samuel. "Synthesize of High Speed Floating-point Multipliers Based on Vedic Mathematics", *Procedia Computer Science*, 2015.
  - [22] Pranoti Y. Panchbhai, Nileshsingh V. Thakur, "Performing Multiplications In Image Filtering Process Using Vedic Mathematics", International Journal of Image Processing and Vision Sciences (IJIPVS), ISSN(Print): 2278-1110, Volume-2 Issue-1
  - [23] Ranjana Kumari, Monali Chinchamalature, "Faster Approach to Image Processing using Vedic Mathematics", IJSRD – International Journal for Scientific Research & Development| Vol.5, Issue 01, 2017 | ISSN (online):2321-0613
  - [24] V.M.Senthilkumar,S.Ravindrakumar,D.Nithya N.V.Kousik A vedic mathematics based Processor core for discrete wavelet transform using FinFET and CNTFET technology for biomedical signal processing, Microprocessors and Microsystems Volume 71, November 2019, 102875
  - [25] Udgirkar G., Indumathi G.,New Horizon college of Engineering, VLSI global routing algorithms: A survey, 2016, Proceedings of the 10th INDIACom; 2016 3rd International Conference on Computing for Sustainable Global Development, INDIACom 2016.