3.3.3 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five

Year	2018-19	2017-18	2016-17	2015-16	2014-15
No.	59	37	92	62	26

Book Chapter

2017-18

Sl. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	Year of publication	ISBN/ISSN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher
1	Dr. E. Venkat Reddy , Mr. I Ravi Kumar	MOBILE AND WIRELESS COMMUNICATIONS	NA	NA	NA	International	2017-2018	978-3-659-77223-8	Bharat Institute of Engineering and Technology	LAMBERT ACADEMIC PUBLISHING, GERMANY-
2	Neeraj Kumar Misra, Bandan Bhoi	Analysis and Optimization of Quantum circuits	NA	NA	NA	international	2017-2018	978-613-9-91317-6	Bharat Institute of Engineering and Technology	LAMBERT ACADEMIC PUBLISHING, GERMANY-
3	G Kishore	Fundamentals Of Image Processing	NA	NA	NA	International	2017-2018	978-613-9-91048-9	Bharat Institute of Engineer	LAMBERT ACADEMIC PUBLISHI

									ing and Technology	NG, GERMANY-
4	Mr. R Satish Kumar Mr. I Ravi Kumar	ANOLOG ELECTRONIC CIRCUITS	NA	NA	NA	International	2017-2018	978-3-659-77507-9	Bharat Institute of Engineering and Technology	LAMBERT ACADEMIC PUBLISHING, GERMANY-
5	Neeraj Kumar Misra, Bibhash Sen, Subodh Wairya, Bandan Boi	Advances in Intelligent Systems and Computing 2019	Novel parity preserving reversible Binary-to-BCD code converter with testability of building blocks in quantum circuit	Proceedings of the Second International Conference on Computational Intelligence and Informatics pp 383-393	Proceedings of the Second International Conference on Computational Intelligence and Informatics	INTERNATIONAL	2017-2018	978-981-10-8228-3	Bharat Institute of Engineering and Technology	Springer, Singapore
6	Ritesh Singh, Neeraj Kumar Misra, Subodh Wairya, Bandan Boi	Advances in Intelligent Systems and Computing 2019	Implementation of Non-restoring Reversible Divider Using a Quantum-Dot Cellular Automata	Computational Intelligence in Data Mining pp 459-469	Computational Intelligence in Data Mining pp 459-469	INTERNATIONAL	2017-2018	978-981-10-8055-5	Bharat Institute of Engineering and Technology	Springer, Singapore

Conference
2017-18

Sl. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	Year of publication	ISBN/ISSN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher
1	Dipesh Popli Parveen Sharma Shubham Verma	NA	Artificial Neural Network Models for the Prediction of Metal Removal Rate in Rotary Ultrasonic Machining	International Conference on Functional Materials, Manufacturing, and Performances (ICFMMP-2019)	International Conference on Functional Materials, Manufacturing, and Performances (ICFMMP-2019)	international	2017-2018	2195-4356	Bharat Institute of Engineering and Technology	NA
2	Dr. Arul Prakash	NA	Arduino based z-source inverter for solar power generation for asynchronous motor	Proceedings of the international multi-conference on computing, communication, electrical and nano technology	international multi-conference on computing, communication, electrical and nano technology	International	2017-2018	978-981-10-5519-5	Bharat Institute of Engineering and Technology	NA

3	Dr. Arul Prakash	NA	Solar power generation system for domestic loads by using FPGA controlled quasi z-source inverter	Proceedings of the international multi-conference on computing, communication, electrical and nano technology	international multi-conference on computing, communication, electrical and nano technology	Internati onal	2017-2018	978-981-10-5519-5	Bharat Institu te of Engine ering and Techn ology	NA
4	Dr. Arul Prakash	NA	Companionability of Modified Z -source Inverter with Solar Power Generation for 3 - Phase aSynchronous Motor	ICRTESM - 2018	2nd - ICRTESM - 2018	Internati onal	2017-2018	978-93-87433-40-3	Bharat Institu te of Engine ering and Techn ology	NA
5	Nallapane ni Manoj Kumar	NA	Development of Single and Multi-jet Conical Nozzle Based Open Jet Facility for Cold Jet Simulation		International Conference on Intelligent Computing and Applications, Advances in Intelligent Systems and Computing	Internati onal	2017-2018	978-981-10-5519-5	Bharat Institu te of Engine ering and Techn ology	Sprin ger

6	Nallapaneni Manoj Kumar	NA	Use of Smart Glasses in Education-A Study	Proceedings of the Second International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)		International	2017-2018	978-1-5386-1442-6	Bharat Institute of Engineering and Technology	IEEE
7	Nallapaneni Manoj Kumar	NA	Optical Head, Mounted Displays (OHMD's) in Visual Inspection of Solar and Wind Power Systems	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	International	2017-2018	978-1-5386-5658-7	Bharat Institute of Engineering and Technology	IEEE
8	Nallapaneni Manoj Kumar	NA	Applicability of Wearable Smart Glass for Solar Power Plant Operation and Maintenance	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	International	2017-2018	978-1-5386-5658-7	Bharat Institute of Engineering and Technology	IEEE

9	Nallapaneni Manoj Kumar	NA	Wearable Smart Glass: Features, Applications, Current Progress and Challenges	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	internati onal	2017-2018	978-1-5386-5658-7	Bharat Institute of Engineering and Technology	IEEE
10	Dr. Ch. Venkatesawara Rao	NA	Electrical Evaluation and Quotation of an Edifice	I2CN- 2k18 (Proceedings of the International multi-conference on computing, communication, electrical and nano technology)	I2CN- 2k18	Internati onal	2017-2018	-	Bharat Institute of Engineering and Technology	NA
11	Mr.J.Nagamalleswarrao, Mr.M.Tharun Kumar	NA	Experimental Investigation of process Parameters on impact strength of A B S F.D.M.Components	1st International Conference on innovations in Mechanical Engineering (ICIME-2018)	1st International Conference on innovations in Mechanical Engineering (ICIME-2018).organized by Gurunanak Institutions,Ibrahimpatnam,Hyderabad	Internati onal Conferen ce	2017-2018		Bharat Institute of Engineering and Technology	NA

12	Vijaya Babu, T., Soni, J.S.	NA	Investigation of process parameters optimization in die-sinking and wire cut EDM to improve process	Materials Today: Proceedings,	Materials Today: Proceedings,	INTERNATIONAL	2017-2018	2214-7853	Bharat Institute of Engineering and Technology	Elsevier
13	P. Ruth Rejoice	NA	Optical Head, Mounted Displays (OHMD's) in Visual Inspection of Solar and Wind Power Systems	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	Second International Conference on Green Computing and Internet of Things (ICGCIoT)	International	2017-2018	978-1-5386-5658-7	Bharat Institute of Engineering and Technology	IEEE
14	Krishnaveni, G., Mounika, K., Navyasree, A.	NA	Buckling Analysis of Composite Cylindrical Shell with Cutout Section	Materials Today: Proceedings,	Materials Today: Proceedings,	International Conference	2017-2018	2214-7853	Bharat Institute of Engineering and Technology	Elsevier

15	S RAHUL , K.S BALA MURGAN, A ANENNDHAR	NA	Consumption of Low power Using CMOS VLSI Design in Modern Trends	3 rd International Conference on Innovative Trends in Engineering, Applied Science and Management ((ICITEASM-2018) at Osmania University Centre for International Programmes, Osmania University Campus,Hyderabad,Telangana State, India	Hyderabad-International Conference on Innovative Trends in Engineering, Applied Science and Management ((ICITEASM-2018)	Internati onal	2017-2018	978-93-87433-27-4	Bharat Institute of Engineering and Technology	NA
16	R. Madanamohana	NA	DIFFERENTIAL DATA ITEMSETS EXTREME	Springer INTERNATIONAL CONFERENCE ON INNOVATIVE IN ENGG. TECHNOLOGY. (Date Added to IEEE Xplore: 19 January 2017)	INNOVATIVE IN ENGG. TECHNOLOGY. (Date Added to IEEE Xplore: 19 January 2017)	Internati onal	2017-2018	9 78-1-5090-1285-5	Bharat Institute of Engineering and Technology	NA

17	Paliwal, S., Kumar Sinha, S., Kumar Chauhan, Y.	NA	Performance optimization of self excited induction generator: A state of art	Recent Developments in Control, Automation and Power Engineering	Recent Developments in Control, Automation and Power Engineering	Internati onal	2017-2018	978-1-5090-3978-4	Bharat Institu te of Engine ering and Techn ology	IEEE
18	Ramaniva s, T., Paramesh war, M., Gayatri, G., Nanubolu, J.B., Srivastava , A.J.	NA	Asymmetric Synthesis of Functionalized 2,5-Pyrrolidinediones and β-Lactams throughDiastereosp ecific Cycloisomerization/ Rearrangement of Chiral Ethanolamine-Derived Ugi Adducts	European Journal of Organic Chemistry	European Journal of Organic Chemistry	Internati onal	2017-2018	1434-193X	Bharat Institu te of Engine ering and Techn ology	IEEE
19	Kumar, N.M., Kumar, M.R., Rejoice, P.R., Mathew, M.	NA	Performance analysis of 100 kWp grid connected Si-poly photovoltaic system using PVsystsimulation tool	Energy Procedia	Energy Procedia	Internati onal	2017-2018	1876-6102	Bharat Institu te of Engine ering and Techn ology	Elsevi er

20	Kulkarni, R.H., Padmanabham, P.	NA	Integration of artificial intelligence activities in software development processes and measuring effectiveness of integration	IET Software	IET Software	International	2017-2018	1751-8814	Bharat Institute of Engineering and Technology	IEEE
21	Kulkarni, R.H., Padmanabham, P., Nadaf, S	NA	PS Redesign for smartphone-using older adults	2nd International Conference on Computing, Communication, Control and Automation	2nd International Conference on Computing, Communication, Control and Automation	International	2017-2018	978-1-5090-3291-4	Bharat Institute of Engineering and Technology	IEEE
22	Krishna, K.H., Kumar, T., Babu, Y.S	NA	Clustering protocols and a few concerns with Clustering algorithms intended for Wireless Sensor systems	Proceedings of 2016 International Conference on ICT in Business, Industry, and Government	Proceedings of 2016 International Conference on ICT in Business, Industry, and Government	International	2017-2018	978-1-5090-5515-9	Bharat Institute of Engineering and Technology	IEEE

23	Nallapaneni Manoj Kumar	NA	Performance Comparison of Building Integrated Multi-Wattage Photovoltaic Generators Mounted Vertically and Horizontally	2017 International Conference On Smart Technology for Smart Nation	2017 International Conference On Smart Technology for Smart Nation	International	2017-2018	978-1-5386-0569-1	Bharat Institute of Engineering and Technology	IEEE
24	Nallapaneni Manoj Kumar	NA	Outdoor measurement of mono and poly c-Si PV modules and array characteristics under varying load in hot-humid tropical climate	7th International Conference of Materials Processing and Characterization	7th International Conference of Materials Processing and Characterization	International	2017-2018	2214-7853	Bharat Institute of Engineering and Technology	Elsevier
25	Nallapaneni Manoj Kumar	NA	Estimation of Grid Feed in Electricity from Roof Integrated Si-amorph PV System Based on Orientation, Tilt and Available Roof Surface Area	2017 International Conference on Intelligent Computing,Instrumentation and Control Technologies (ICICICT)	2017 International Conference on Intelligent Computing,Instrumentation and Control Technologies (ICICICT)	International	2017-2018	978-1-5090-6106-8	Bharat Institute of Engineering and Technology	IEEE

26	Mr. A. Nagaraju	NA	A strategic Markov Approach for Reliability assessement of engineering systems	SSIEEC - 2017 (International Conference on smart and sustainable initiatives for energy within environmental constrains)	SSIEEC - 2017, Malaysia	International	2017-2018		Bharat Institute of Engineering and Technology	NA
27	Mr.J.Nagamalleswarrao, Mr A.Chennakesava Reddy, Mr.P.V.Rama rao	NA	Experimental Evaluation of the Influence of process parameters on Surface Roughness in Components produced by 3-D Printing(FDM)	2nd International Conference on innovations in Engineering, Organized by Auroras Scientific, Technical and Research Academy	2nd International Conference on innovations in Engineering, Organized by Auroras Scientific, Technical and Research Academy, chandrayana gutta,Hyderabad.	International Conference	2017-2018	2250-0138	Bharat Institute of Engineering and Technology	NA

28	Mr.J.Nagamalleswarrao, Dr.C.S.Krishnaprasad Rao, Mr .M.Pramod kumar reddy, Mr.M.Revanth kumar	NA	Optimization of Shear spinning parameters for production of seamless Rocket motor Tube by Taguchi Method	1ST National conference on innovative approaches in mech engg	1ST National conference on innovative approaches in mech engg,sept 22-23,2017,organized by St. Martin Engineering college,dhulapally,Hyderabad:	National conference	2017-2018	2278-1684	Bharat Institute of Engineering and Technology	NA
29	G.Madhu Babu1 ,K. Pavan Kumar Reddy2	NA	DESIGN AND FABRICATION OF MULTI-FUNCTIONAL ELEVATOR	National Conference on Emerging Trends in Mechanical Engineering (e-TIME"16)	National Conference on Emerging Trends in Mechanical Engineering (e-TIME"16)	National	2017-2018		Bharat Institute of Engineering and Technology	NA
30	G.Kumaraswamy Rao	NA	Protection of Crowded Sport Arenas, Public Meetings and VVIP Convoys from Remotely Controlled Explosive Devices (RCIEDs)	Electronics and Communication Technologies: Learning From Past & Towards Future"	International OU Centenary International Conference (OU 100 ECE) on 28 December 2017	International	2017-2018	NA	Bharat Institute of Engineering and Technology	NA

31	G.Kumara swamy Rao	NA	Innovative Techniques in Protective Technologies to Detect and Mute RCIEDs (Radio Controlled Improvised Explosive Devices)	2nd National Conference on Recent Advances in Electronics, held on 24th & 25th February 2017at ICFAI Technical	ICFAI RCIED FEB -17	National	2017-2018	NA	Bharat Institute of Engineering and Technology	NA

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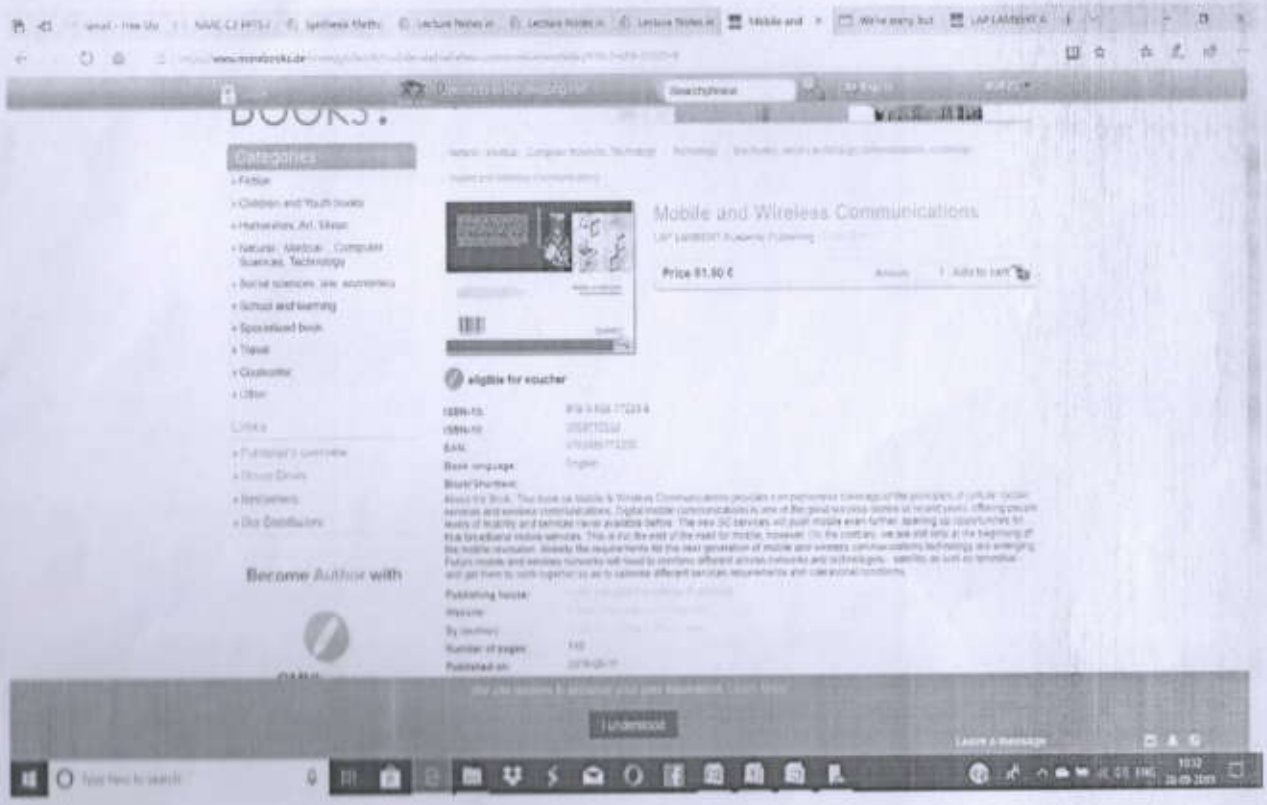
TEXT BOOK 1 -2018

MOBILE AND WIRELESS COMMUNICATIONS

https://www.morebooks.de/store/gb/book/mobile-and-wireless-communications/isbn/978-3-659-77223-8



E. Venkat Reddy
I. Ravi Kumar

Mobile and Wireless Communications

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Imprint

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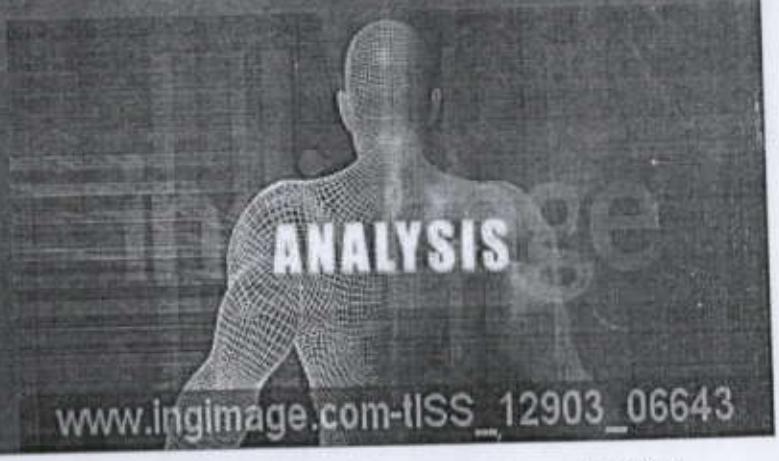
Printed at: see last page
ISBN: 978-3-659-77223-8

The aim of this novel work is to fill a gap that has appeared in the reversible computing, emerging domain of Futuristic Quantum Information Science. Themes in Quantum Information Science have been an emerging domain. This work targets the basic level void by terminology coverage of quantum circuit synthesis. Chapters introduce the synthesis approach of reversible adders, comparator, code converters, and median filter. This book then covers decomposition, mapping and optimization tools in quantum logic circuits. The flow of the work is organized to understand the synthesis of a quantum circuit that begins using quantum gates and then move into physical implementation on nano-computing technology.



Neeraj Misra
Bandan Kumar Bhoi

Analysis and Optimization of Quantum circuits

Neeraj Kumar Misra is Associate Professor and Academic In-charge in the Department of Electronics and Communication Engineering at Bharat Institute of Engineering & Technology (BIET), Hyderabad. Bandan Kumar Bhoi is an AP in the Department of Electronics and Tele-communication Engineering at Veer Surendra Sai University of Technology, Burla Odisha

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TEXTBOOK2 -2018

Analysis and Optimization of Quantum circuits

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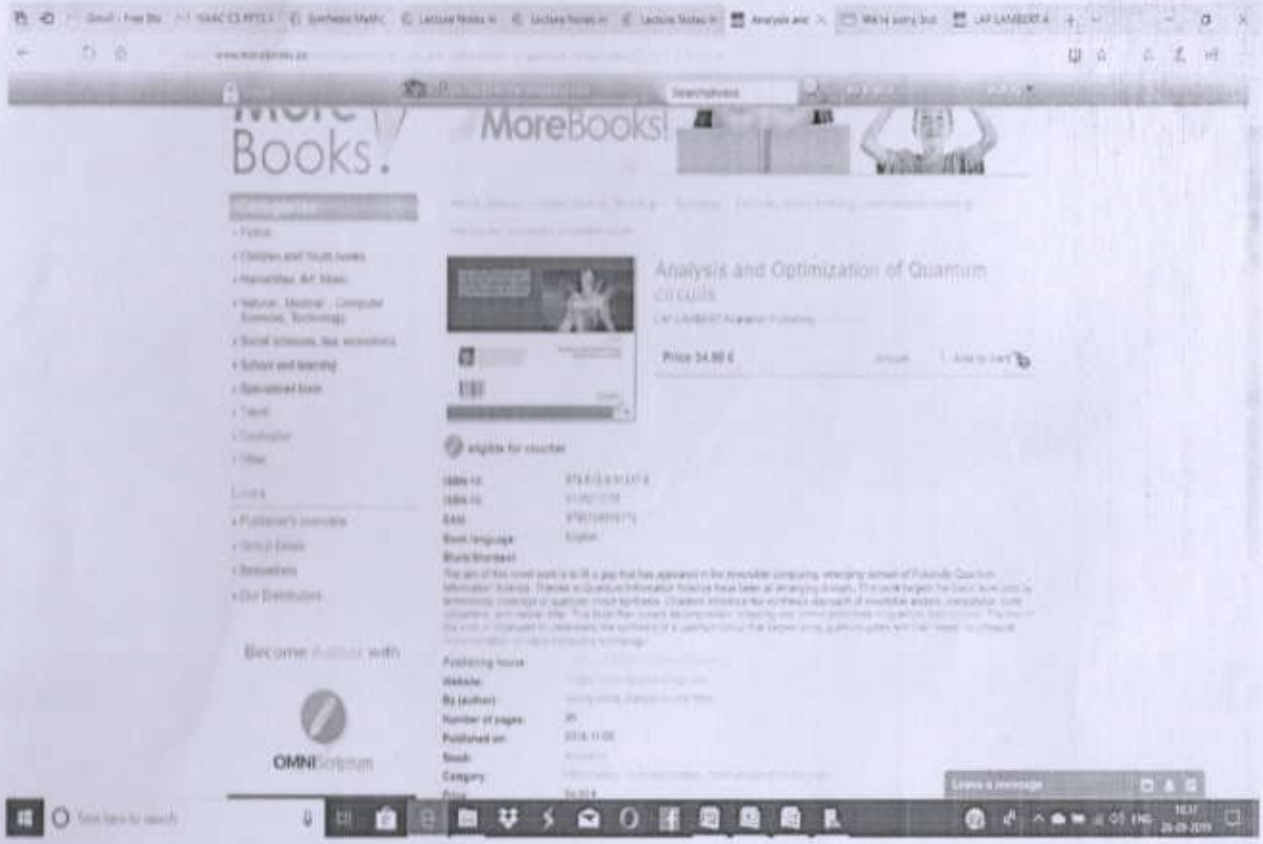

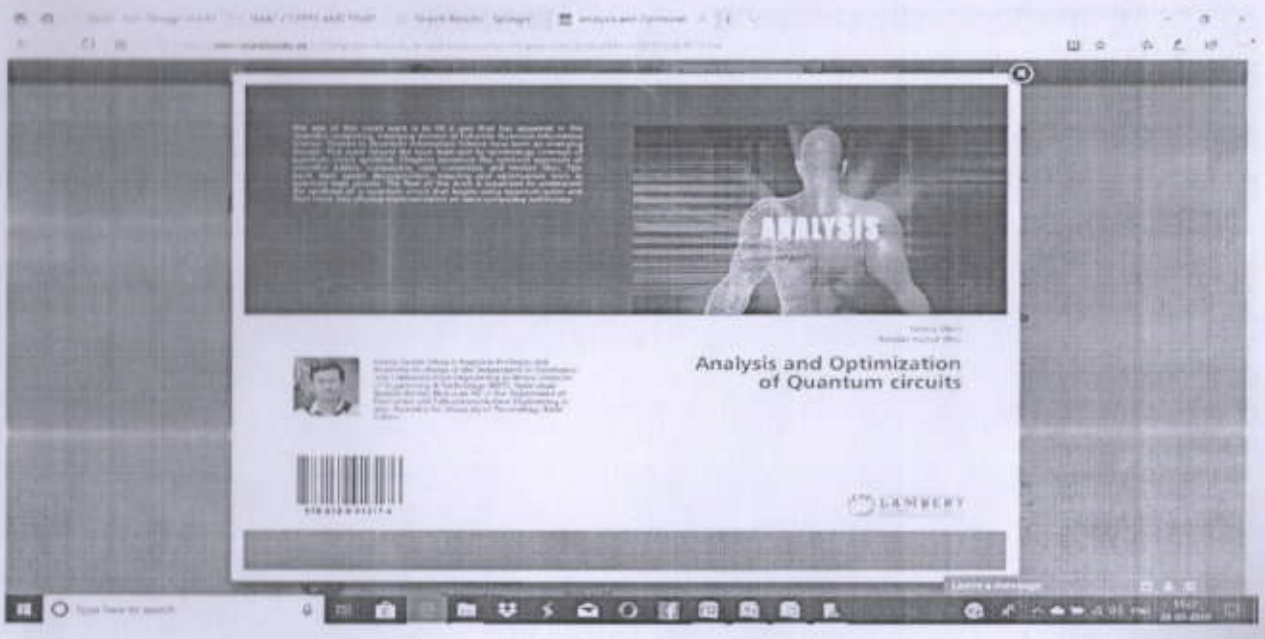

TEXT BOOK3 -2018

Fundamentals Of Image Processing

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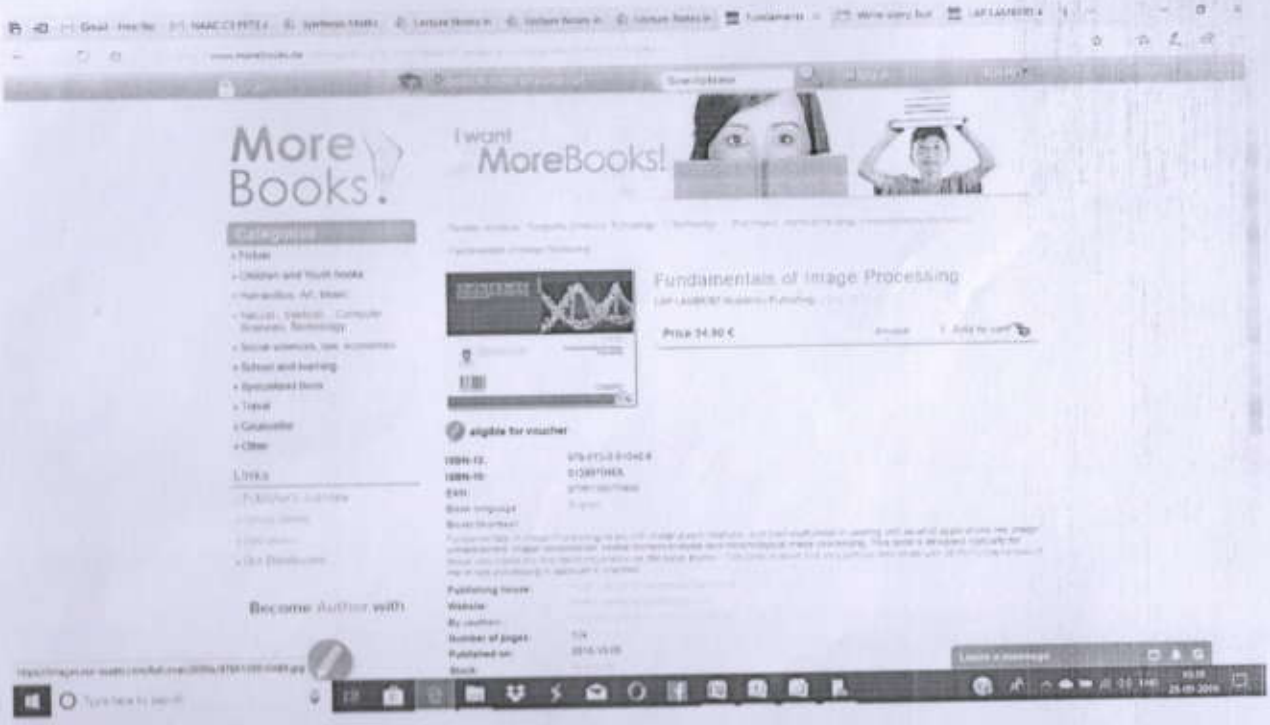

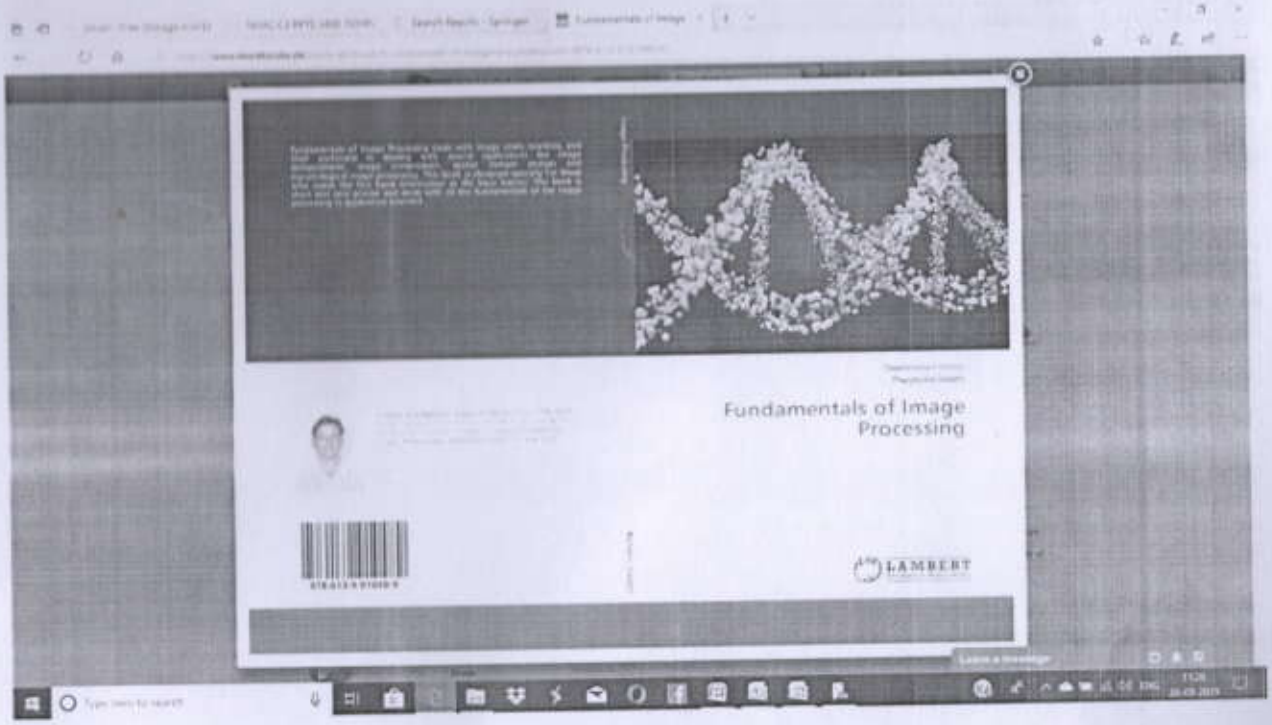

Booktitle:
Fundamentals of Image

ISBN-13:
978-613-9-91048-9

ISBN-10:
613991048X

EAN:
9786139910489

Book language:
English

Blurb/Shorttext:
Fundamentals of Image Processing deals with image pixels
book is designed specially for those who needs the first hand

Publishing house:
LAP LAMBERT Academic Publishing

Webelle:

By (author):

Number of pages:
104

Published on:
2018-10-05

Stock:

Category:

Price:
54.90 €

Keywords:

Fundamentals of Image Processing deals with image pixels their usefulness in dealing with several applications enhancement, image compression, spatial domain morphological image processing. This book is designed spec who needs the first hand information as the basic learner. short and very precise and deals with all the fundamentals processing in application oriented.

Geedimalla Kishore, Assistant Professor in ECE India completed his B.Tech and M.Tech from J His area of interest involved in Signal Processin Image Processing, Embedded Systems and VLS

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TEXT BOOK 4 -2018

ANOLOG ELECTRONIC CIRCUITS

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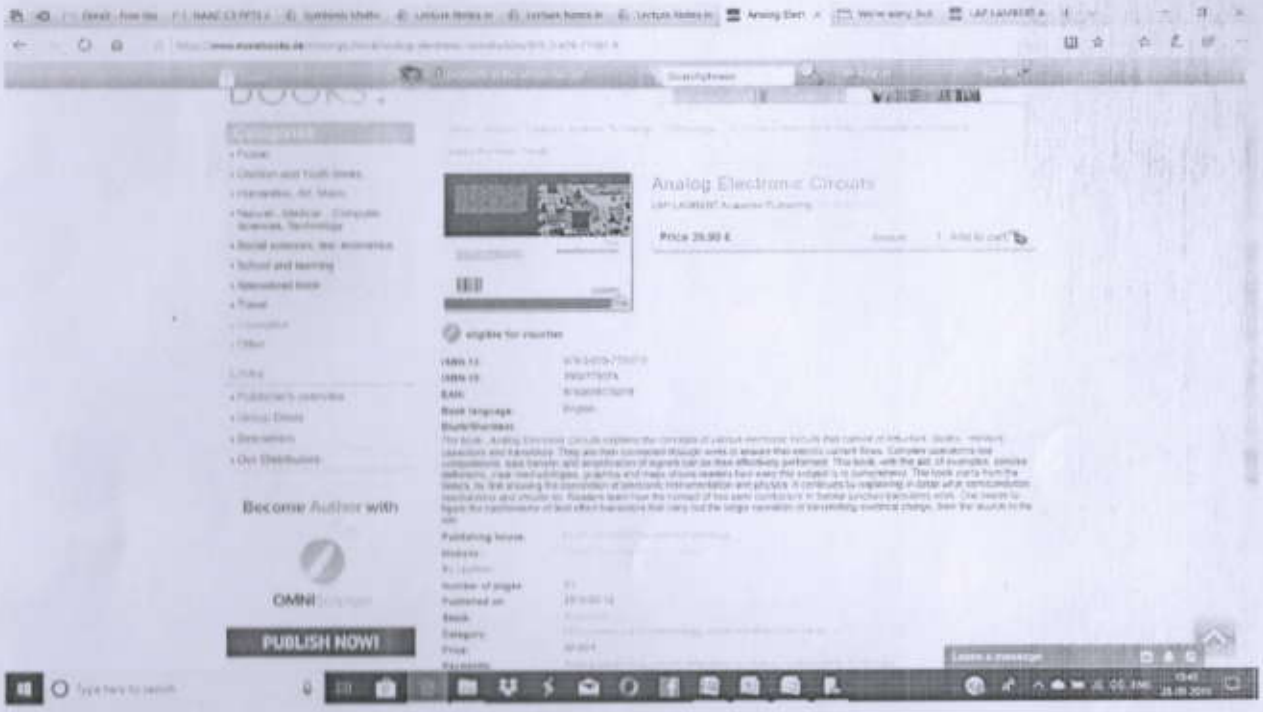
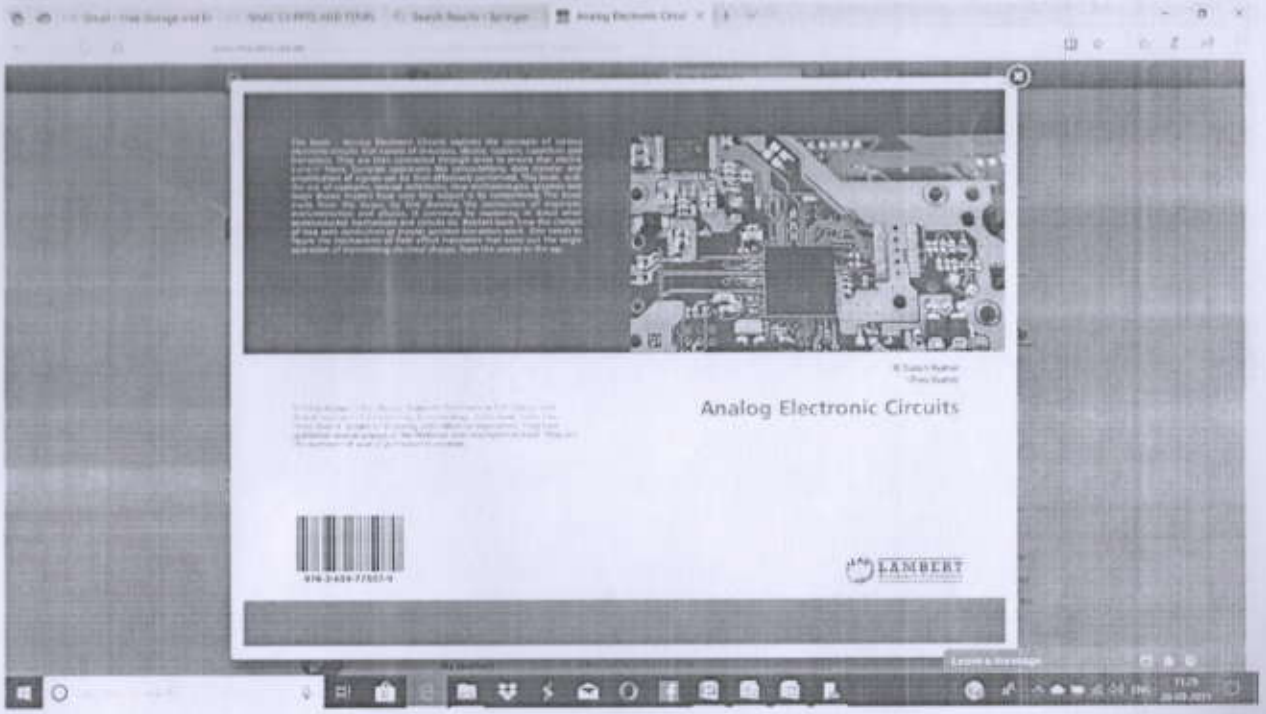
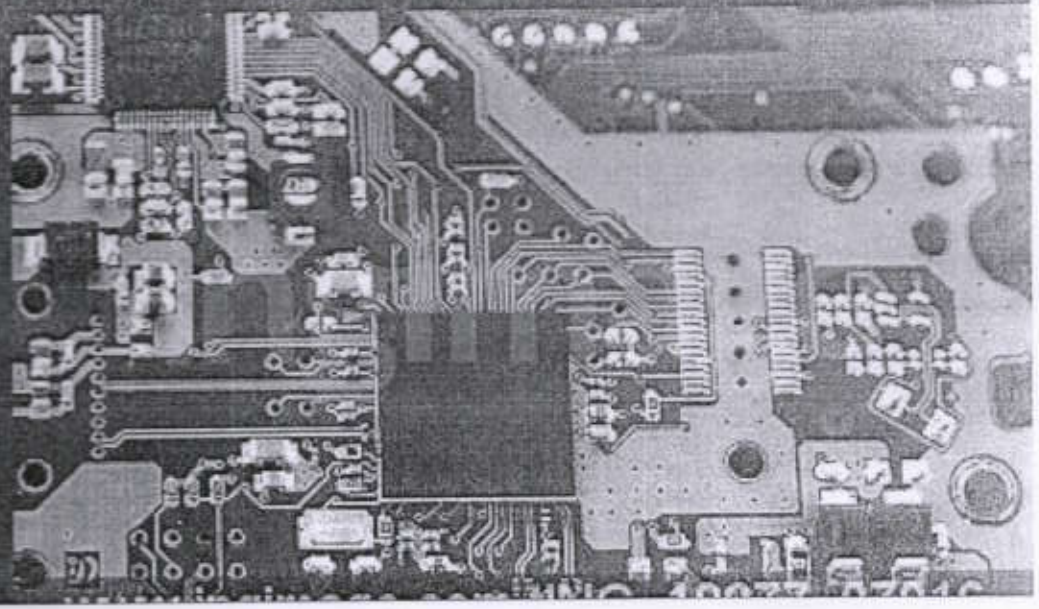




The book , Analog Electronic Circuits explains the concepts of various electronic circuits that consist of inductors, diodes, resistors, capacitors and transistors. They are then connected through wires to ensure that electric current flows. Complex operations like computations, data transfer and amplification of signals can be then effectively performed. This book, with the aid, of examples, concise definitions, clear methodologies, graphics and maps shows readers how easy this subject is to comprehend. The book starts from the basics, by first showing the connection of electronic instrumentation and physics. It continues by explaining in detail what semiconductor mechanisms and circuits do. Readers learn how the contact of two semi conductors or bipolar junction transistors work. One needs to figure the mechanisms of field effect transistors that carry out the single operation of transmitting electrical charge, from the source to the sap.



R.Satish Kumar
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Analog Electronic Circuits

R.Satish Kumar, I.Ravi Kumar Associate Professors in ECE Department, Bharat Institute of Engineering & Technology, Hyderabad, India have more than a decade of teaching and industrial experience. They have published several papers at the National and International levels. They are life members of several professional societies.

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R.Satish Kumar
I.Ravi Kumar

Analog Electronic Circuits

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ISBN: 978-3-659-77507-9

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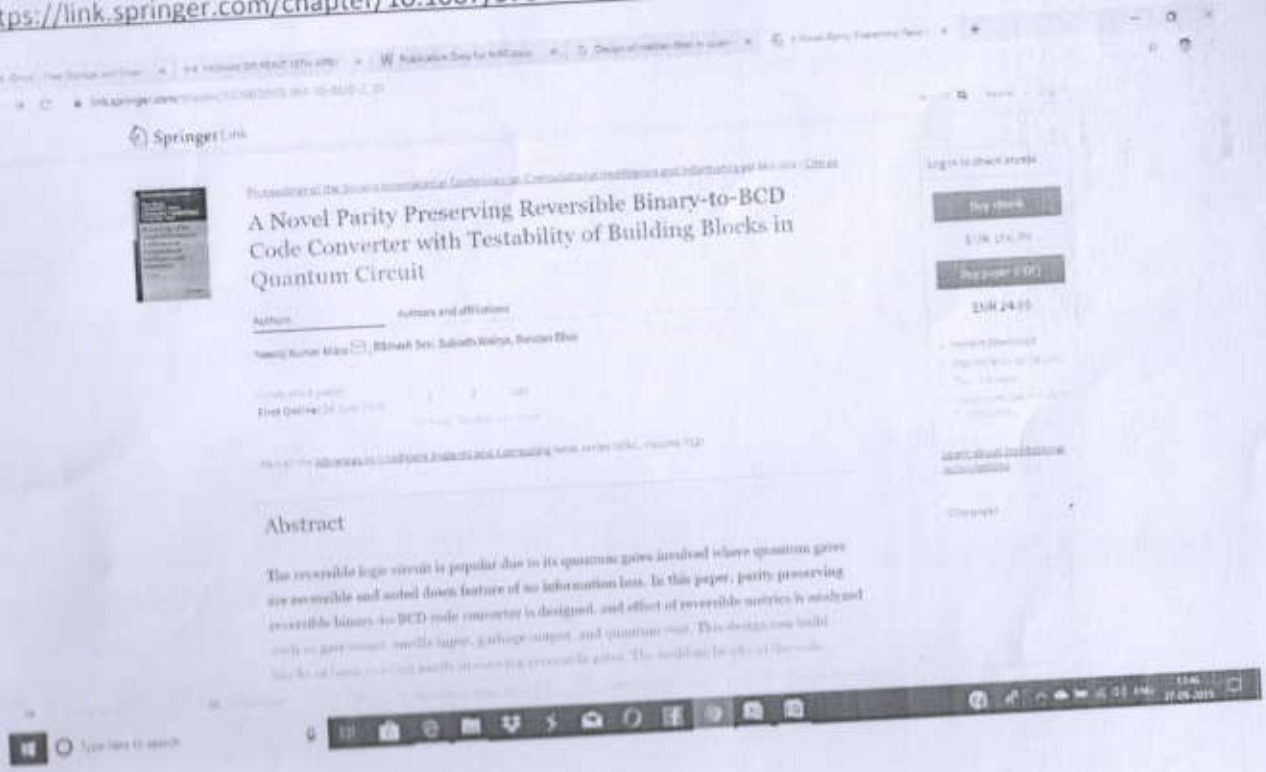
BOOK CHAPTER 5

Novel parity preserving reversible Binary-to-BCD code converter with testability of building blocks in quantum circuit

https://link.springer.com/chapter/10.1007/978-981-10-8228-3_35



A Novel Parity Preserving Reversible Binary-to-BCD Code Converter with Testability of Building Blocks in Quantum Circuit

Neeraj Kumar Misra, Bibhash Sen, Subodh Wairya and Bandan Bhoi

Abstract The reversible logic circuit is popular due to its quantum gates involved where quantum gates are reversible and noted down feature of no information loss. In this paper, parity preserving reversible binary-to-BCD code converter is designed, and effect of reversible metrics is analyzed such as gate count, ancilla input, garbage output, and quantum cost. This design can build blocks of basic existing parity preserving reversible gates. The building blocks of the code converter reversible circuit constructed on Toffoli gate based as well as elemental gate based such as CNOT, C-V, and C-V+ gates. In addition, qubit transition analysis of the quantum circuit in the regime of quantum computing has been presented. The heuristic approach has been developed in quantum circuit construction and the optimized quantum cost for the circuit of binary-to-BCD code converter. Logic functions validate the development of quantum circuit. Moving the testability aim are figured in the quantum logic circuit testing such as single missing gate and single missing control point fault.

Keywords Reversible computation · Quantum circuit · Quantum Toffoli gate Testability · Code converter

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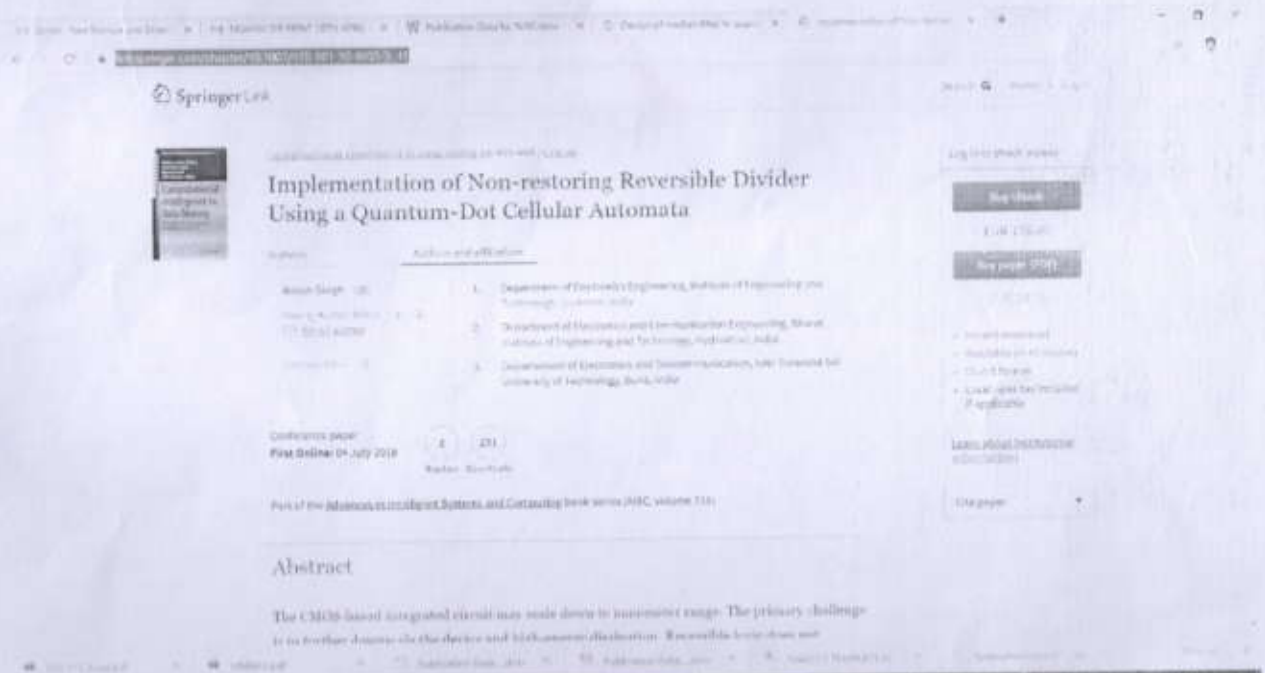
V. Bhateja et al. (eds.), *Proceedings of the Second International Conference on Computational Intelligence and Informatics*, Advances in Intelligent Systems and Computing 712, https://doi.org/10.1007/978-981-10-8228-3_35

BOOK CHAPTER 7

Implementation of Non-restoring Reversible Divider Using a Quantum-Dot Cellular Automata

https://link.springer.com/chapter/10.1007/978-981-10-8055-5_41



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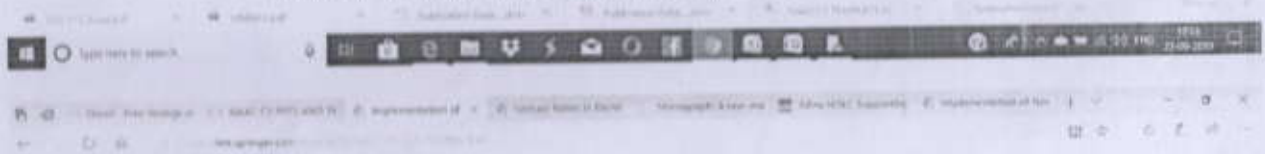
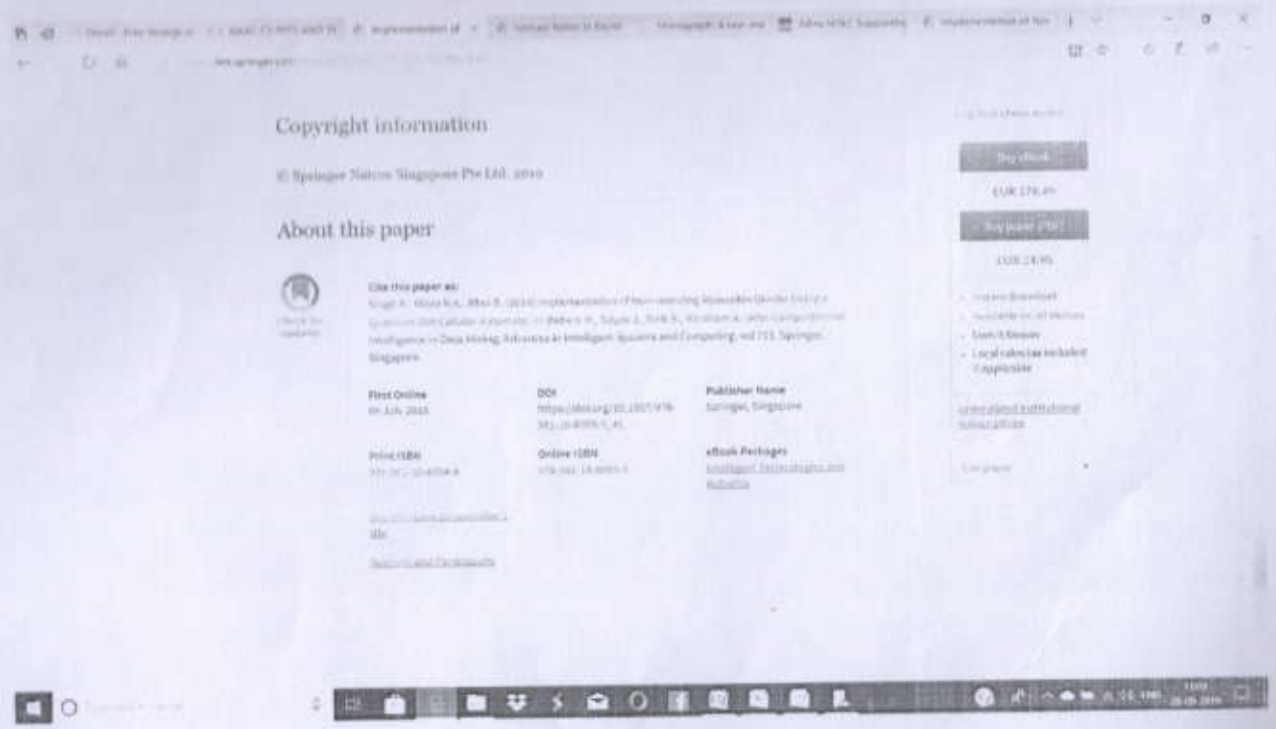
Implementation of Non-restoring Reversible Divider Using a Quantum-Dot Cellular Automata

Conference paper
First Online: 04 July 2018

Abstract





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Advances in Intelligent Systems and Computing 711

Himansu Sekhar Behera
Janmenjoy Nayak
Bighnaraj Naik
Ajith Abraham *Editors*

Computational Intelligence in Data Mining

Proceedings of the International Conference on CIDM 2017

Springer

Implementation of Non-restoring Reversible Divider Using a Quantum-Dot Cellular Automata

Ritesh Singh, Neeraj Kumar Misra and Bandan Bhoi

Abstract The CMOS-based integrated circuit may scale down to nanometer range. The primary challenge is to further downscale the device and high-energy dissipation. Reversible logic does not dissipate energy and no information loss. In this way, the state-of-the-art technology such as QCA was forced toward high-speed computing with negligible energy dissipation in the physical foreground. This work targets the design of non-restoring reversible divider circuit and its implementation in QCA. We have utilized few 2 × 2 FG and 4 × 4 HNG gates as the block construction and also show the QCA implementation having cost-efficient approach. Further, the divider circuit has synthesized with FG and HNG gates and QCA implementation. This divider circuit inherits many benefits such as fewer garbage outputs, reduce quantum cost are achieved, and also reduced QCA primitives can be improved by using efficient QCA layout scheme. Simulation investigations have been verified by QCA Designer. The proposed non-restoring divider also compares the reversible metrics results with some of other existing works.

Keywords Quantum-dot cellular automata · Nanoelectronics · Clocking Reversible computing · High-speed nanoelectronics

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Advances in Intelligent Systems and Computing 711,
https://doi.org/10.1007/978-981-10-8055-5_41

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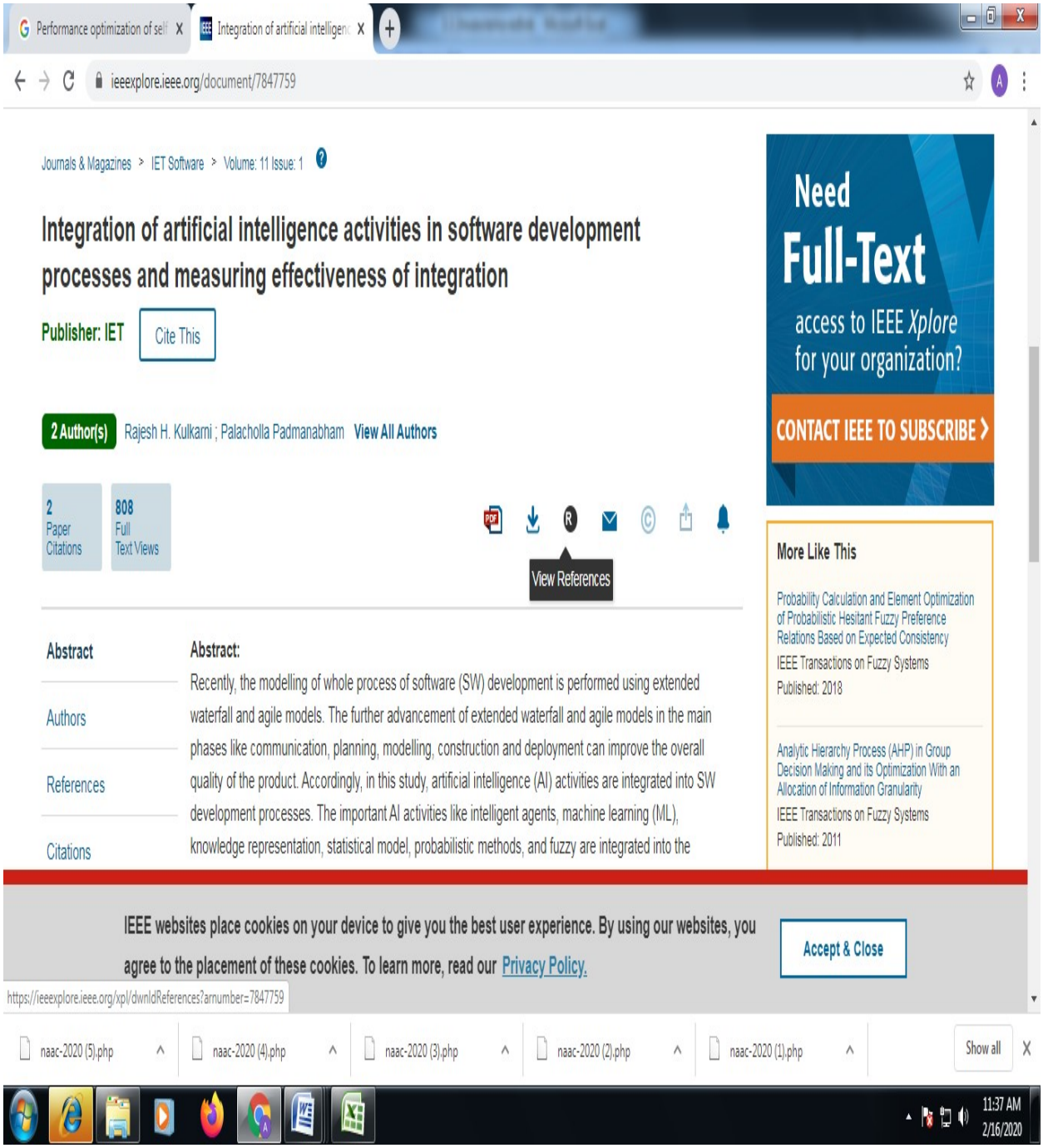

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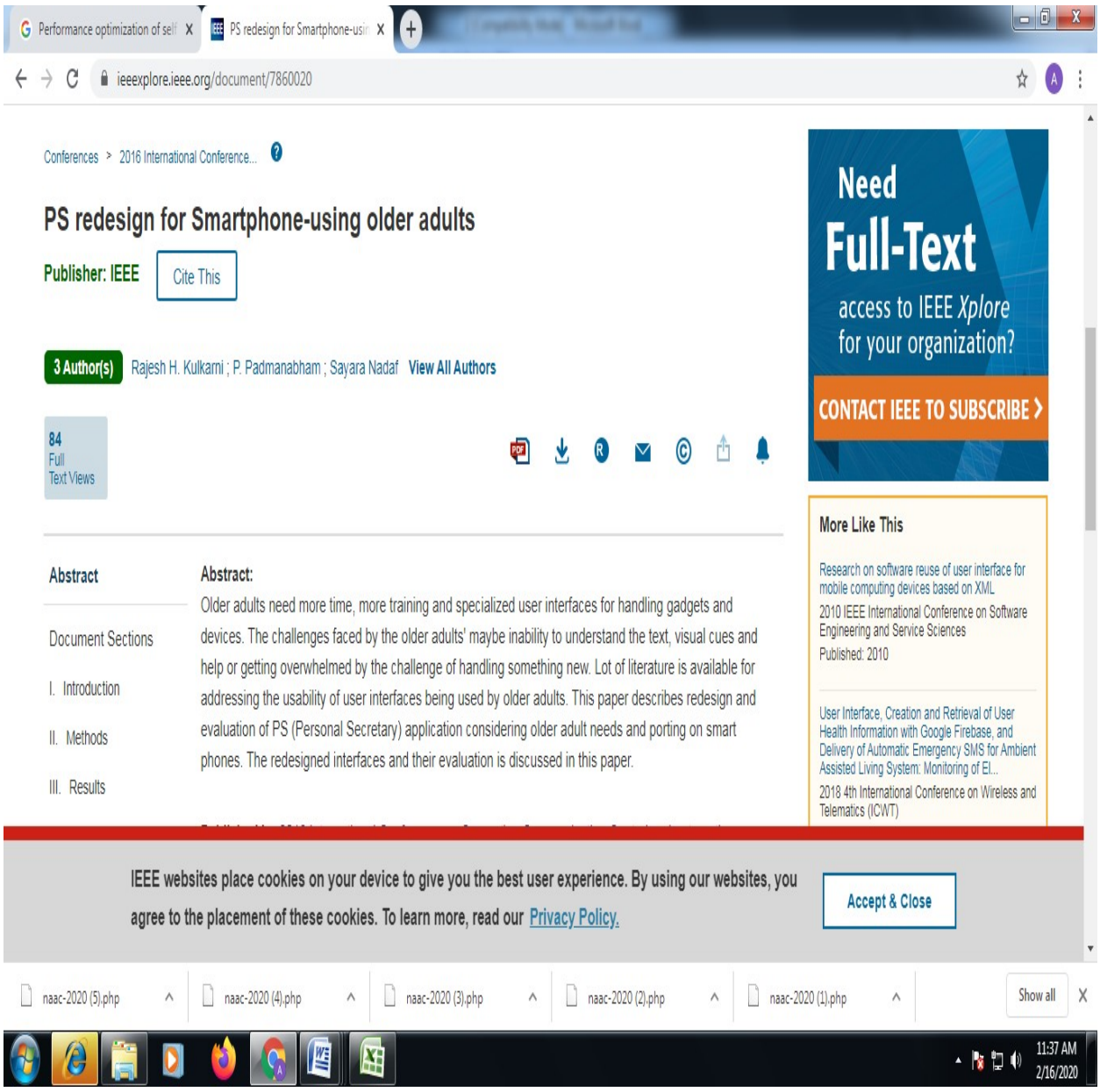
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Abstract
Document Sections
I. Introduction
II. Methods
III. Results
Abstract:
Older adults need more time, more training and specialized user interfaces for handling gadgets and devices. The challenges faced by the older adults' maybe inability to understand the text, visual cues and help or getting overwhelmed by the challenge of handling something new. Lot of literature is available for addressing the usability of user interfaces being used by older adults. This paper describes redesign and evaluation of PS (Personal Secretary) application considering older adult needs and porting on smart phones. The redesigned interfaces and their evaluation is discussed in this paper.
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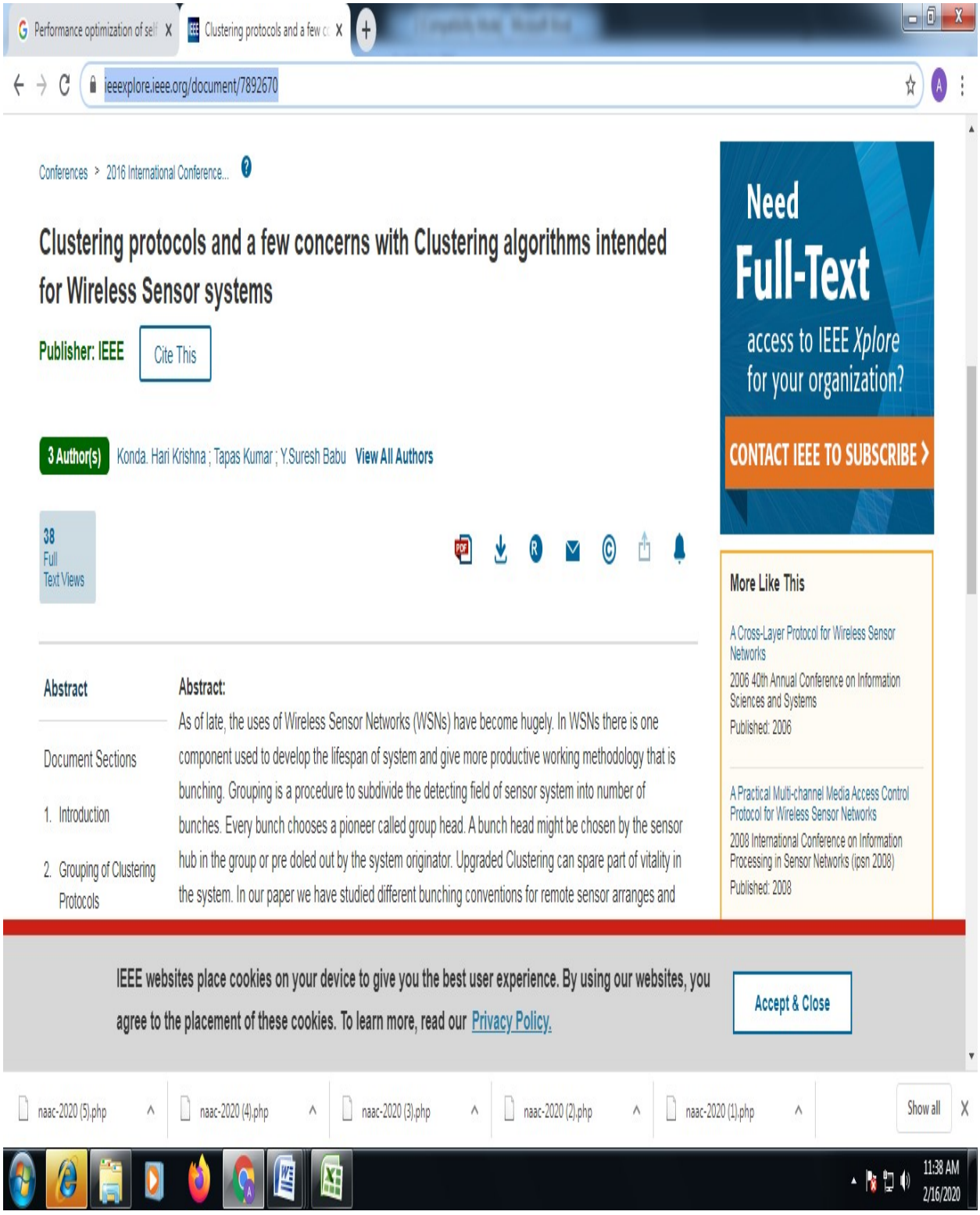

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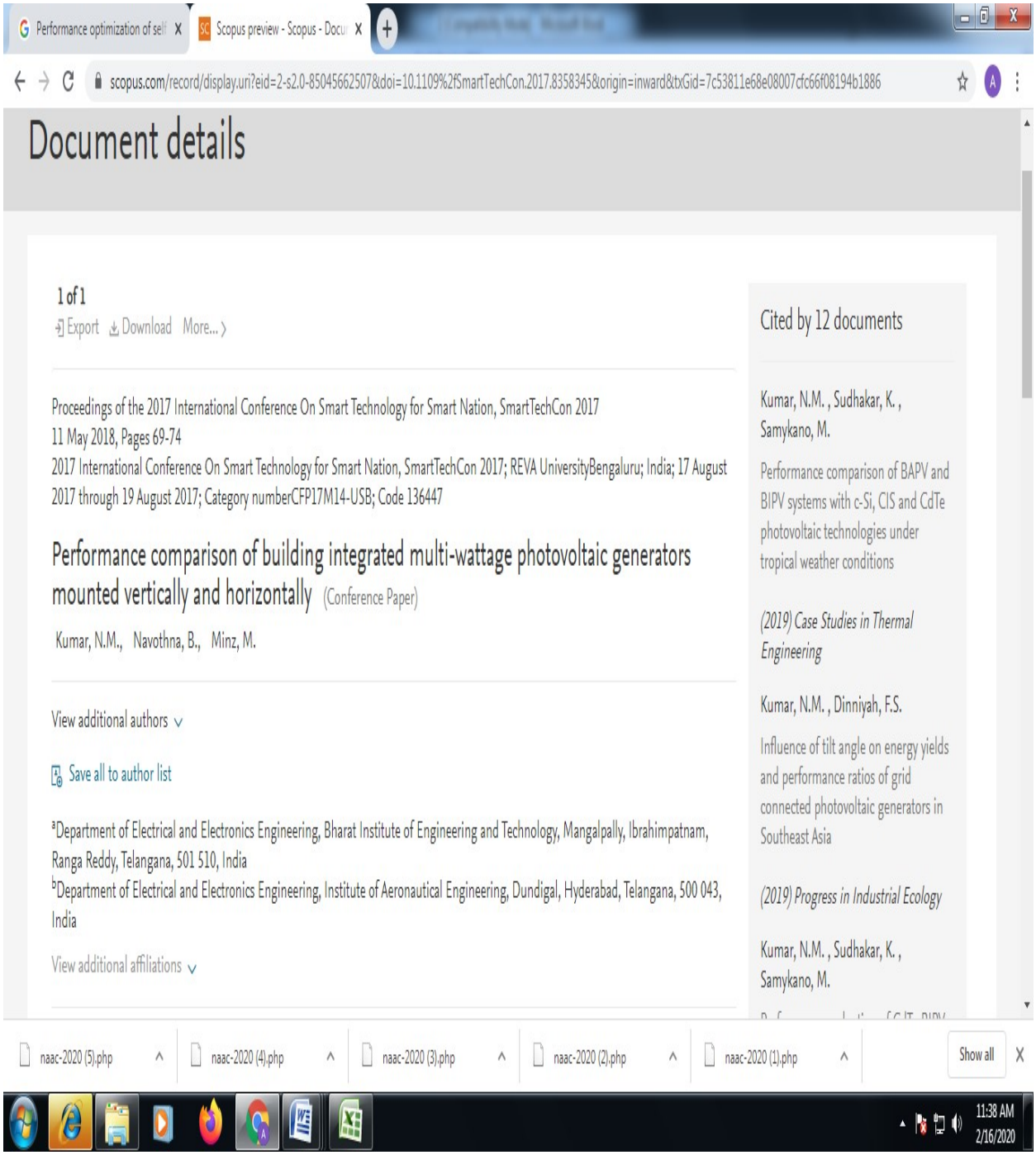

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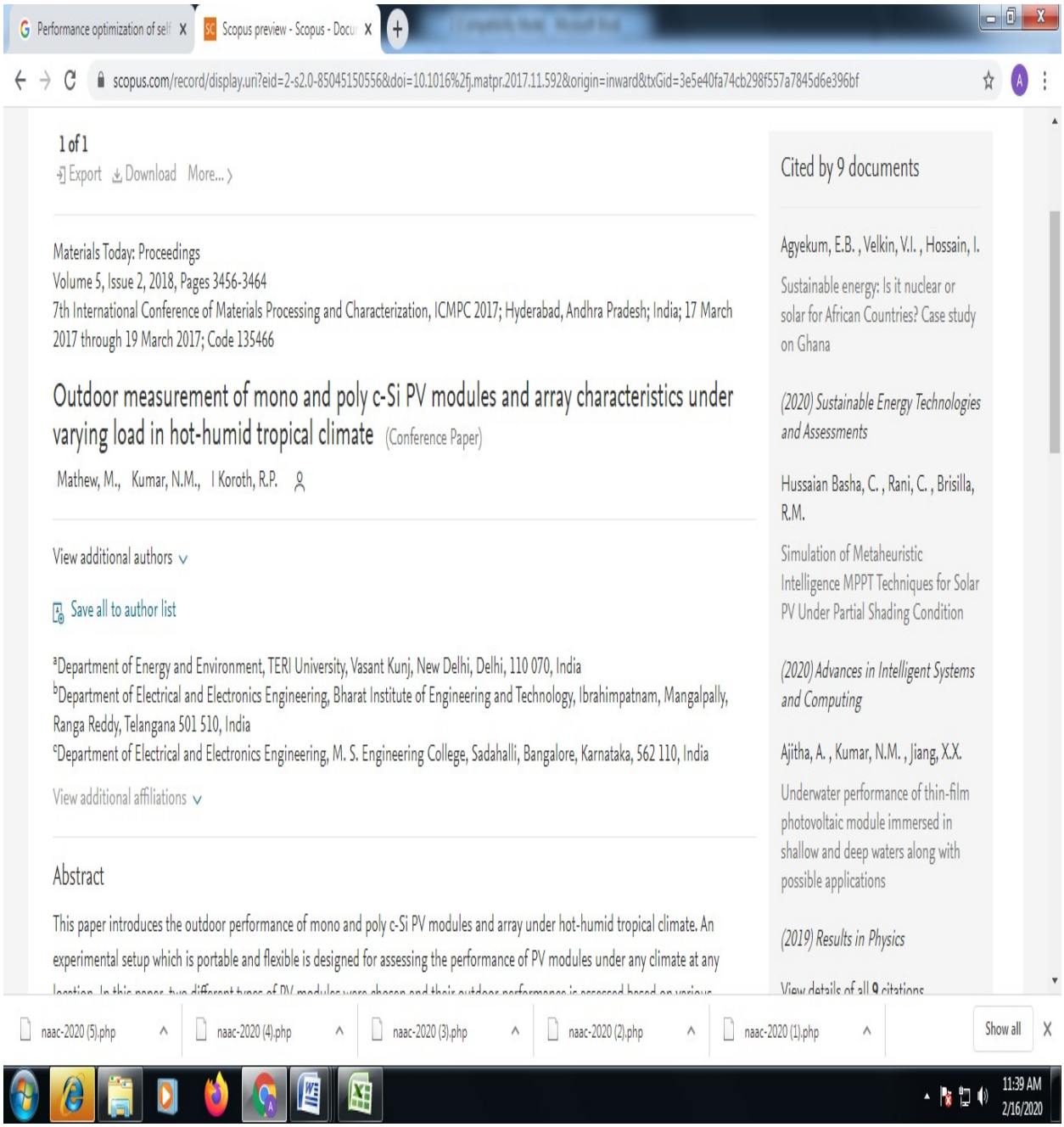
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7th International Conference of Materials Processing and Characterization, ICMPC 2017; Hyderabad, Andhra Pradesh; India; 17 March 2017 through 19 March 2017; Code 135466
Outdoor measurement of mono and poly c-Si PV modules and array characteristics under varying load in hot-humid tropical climate (Conference Paper)
Mathew, M., Kumar, N.M., I Koroth, R.P.
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Abstract
This paper introduces the outdoor performance of mono and poly c-Si PV modules and array under hot-humid tropical climate. An experimental setup which is portable and flexible is designed for assessing the performance of PV modules under any climate at any
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Ajitha, A. , Kumar, N.M. , Jiang, X.X.
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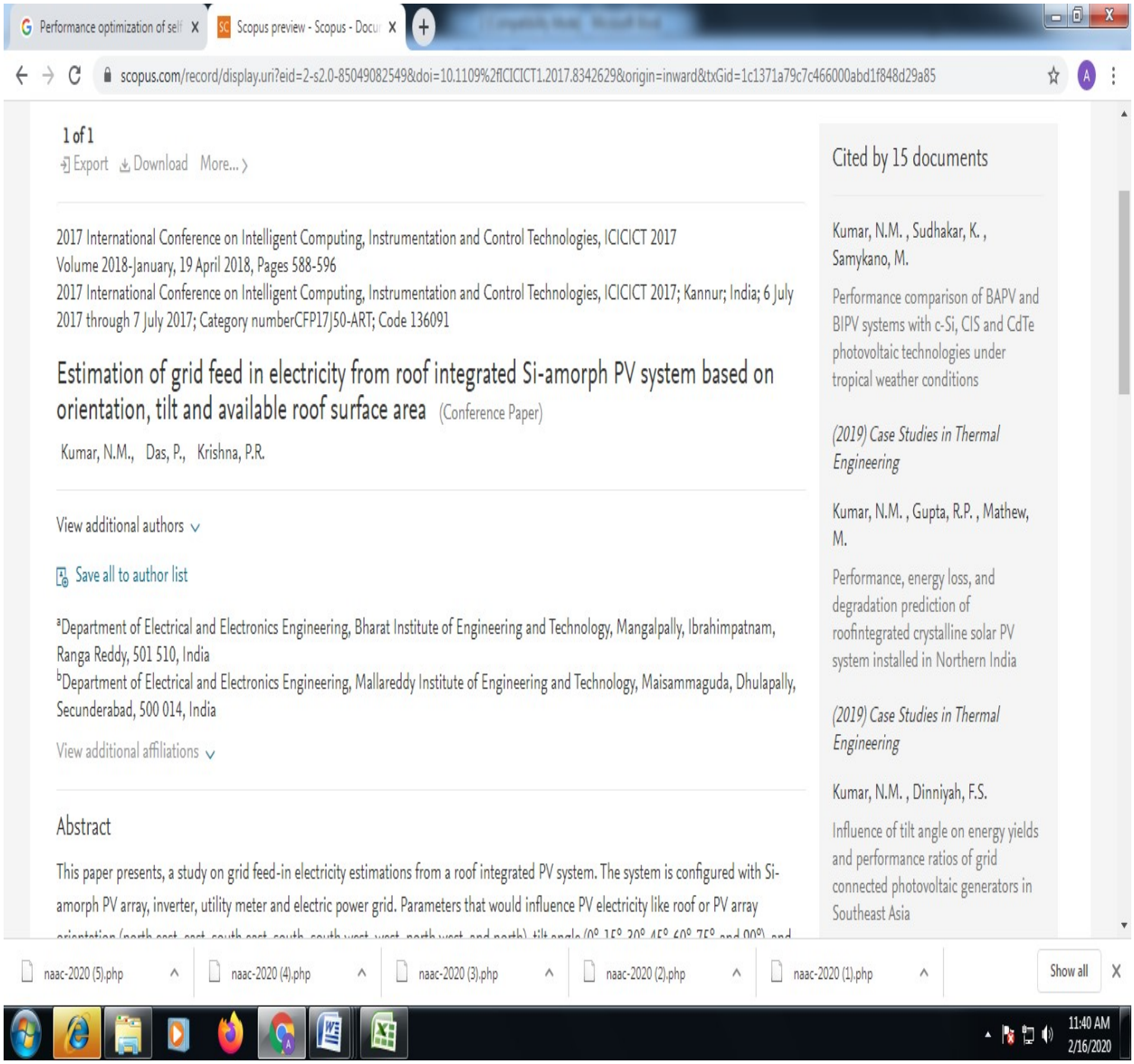

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Volume 2018-January, 19 April 2018, Pages 588-596
2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies, ICICICT 2017; Kannur; India; 6 July 2017 through 7 July 2017; Category numberCFP17J50-ART; Code 136091

Estimation of grid feed in electricity from roof integrated Si-amorph PV system based on orientation, tilt and available roof surface area (Conference Paper)

Kumar, N.M., Das, P., Krishna, P.R.

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[a]Department of Electrical and Electronics Engineering, Bharat Institute of Engineering and Technology, Mangalpally, Ibrahimpatnam, Ranga Reddy, 501 510, India
[b]Department of Electrical and Electronics Engineering, Mallareddy Institute of Engineering and Technology, Maisammaguda, Dhulapally, Secunderabad, 500 014, India

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Abstract

This paper presents, a study on grid feed-in electricity estimations from a roof integrated PV system. The system is configured with Si-amorph PV array, inverter, utility meter and electric power grid. Parameters that would influence PV electricity like roof or PV array

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Kumar, N.M. , Sudhakar, K. , Samykano, M.
Performance comparison of BAPV and BIPV systems with c-Si, CIS and CdTe photovoltaic technologies under tropical weather conditions
(2019) Case Studies in Thermal Engineering

Kumar, N.M. , Gupta, R.P. , Mathew, M.
Performance, energy loss, and degradation prediction of roofintegrated crystalline solar PV system installed in Northern India
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Kumar, N.M. , Dinniyah, F.S.
Influence of tilt angle on energy yields and performance ratios of grid connected photovoltaic generators in Southeast Asia

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Proceedings of the International Multi-Conference on Computing, Communication, Electrical & Nanotechnology (I2CN-2K18) held on 26th & 27th April, 2018

Arduino Based Z-Source Inverter for Solar Power Generation for Asynchronous Motor

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***Abstract*—ZSI (Z-Source Inverter) has unique characteristics than the VSI (Voltage Source Inverter) and CSI (Current Source Inverter), which make it to find spaces in attractive applications like electric hybrid vehicle and industrial drives. This paper proposes the impedance source network(ZSI) between the solar power generation and inverter circuit to provide voltage buck and boost properties with which the same kind of properties cannot be achieved with traditional voltage source and current source inverters. This method eliminates the low-frequency ripples in the induction current and capacitor voltage by maintaining the shoot through duty cycle constant, and minimize the voltage stresses of switching devices at the same time. The gate pulse for the inverter switches are generated by the Arduino controller, in which the generation of code and modification is easy. The proposed system is simulated in Matlab for the solar power generation to feed an asynchronous motor.**

Keywords*—ZSI, Solar power generation,*DC-AC Power conversion,Arduino controller, Asynchronous motor

I.INTRODUCTION

Due to the rigorous diminishing of the conventional energy resources, almost all the countries are concentrating to develop alternate sources. Solar energy is one of the promising renewable and alternate energy source available in almost all regions of the earth except polarregions. In near future solar energy will occupy most of the industries like transportation, small scale to big industrial loads and domestic loads. In the way of adding important to the solar power generation, research is also going in full swing in developing different types of solar panels, different types of converters and inverters, different controlling techniques of inverters, and various types of batteries.One of the key element in the solar power generation is the dc to ac inverter and the designing of controller for the inverter also plays major role in deciding the efficiency of the inverter. Nowadays due to the advancement in the embedded technology, an ample number of controllers can be designed for controlling the inverters and converters. The main focus of the proposed work lies in the implementation of Arduino for designing the controller for the inverter. The impedance network is also an important part of the proposedwork and it isemployed for the boosting the output energy from the solar panel.

II.PROPOSED SYSTEM

The proposed system with boost DC –AC converter is as shown in the given figure 1.

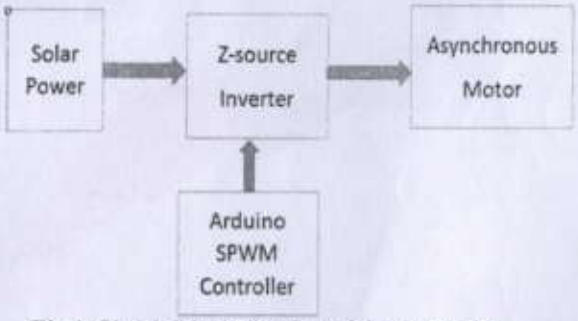

Fig 1. Simple block diagram of the Proposed system.

The proposed model consists of Solar photo voltaic panel, Z- source inverter, Arduino controller and a asynchronous motor.The solar power, which has been generated from the solar panel is direct current and it is subjected to boosting with the help of impedance network. The boosted output of the impedance network is given to the inverter to convert into alternating current. The inverter used in the proposed model is a two leg inverter consisting of four semiconductor switches and each pair of switch is triggered by separate gate signal depending upon the duty cycle. The gate signal is generated by Arduino controller. Then the alternating output

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Solar Power Generation System For Domestic Loads By Using FPGA Controlled Quasi Z Source Inverter

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Abstract—**The self-reliance of energy for the individual domestic loads has been one of the important area of research and to debate too. The advancements in the area of photo voltaic panel, converters and its controllers pave the way to become the self-sufficiency in the solar power generation for each and everyone of their own energy demand. In this paper both linear and nonlinear load of domestic sector are considered to prove the efficiency of the designed solar power generation system in which the inverter is controlled by the FPGA(Field Programmable Gate Array) controller. The entire system has been designed in MATLAB environment with the study of THD (Total Harmonic Distortion) of the output voltage and output current.**

Keywords—*FPGA, quasi-ZSI, Solar power generation, DC-AC Power conversion.*

I.INTRODUCTION

The consumption of conventional energy resources precedes to various pollutions and global warming in dangerous level. Also the economy of almost all countries are calculated by the factors like import and export of conventional fuels like petroleum products. Moreover the decreasing rate of reserves of traditional fuels is also high. Hence in this scenario there is a high need of finding alternate source for replacing the conventional energy sources. Among all the available renewable energy sources, solar energy is the most hopefuland promising renewable source available in almost all regions of the earth except polarregions. In the way of adding important to the solar power generation, research is also going in full swing in developing different types of solar panels, different types of converters and inverters, different controlling techniques of inverters, and various types of batteries.Field Programmable Gate Array (FPGA) is a digital integrated circuit, which can be programmed to do any type of digital functions. Generally it consists of logic blocks, flip-flops and I/O blocks. Due to the advantages of FPGA like processing capability, it has been used nowadays in various digital control system applications. In order to avoid the drawbacks of the traditional Current Source Inverter (CSI) and Voltage Source Inverter (VSI), the quasi Z source inverter is used. The q-ZSI is formed by the combinational network of two inductors and two capacitors, which receiving more attention nowadays in solar power generation system and moreover the q-zsi has the unique advantages of lower component ratings and constant dc current from the source. The solar energy has been generated by using q-zsi and the output is applied to the linear and nonlinear loads of domestic applications. The whole system has been modeled and analysed in Matlab Simulink.

II.PROPOSED SYSTEM

The proposed system with boost DC –AC converter is shown in the given figure 1.

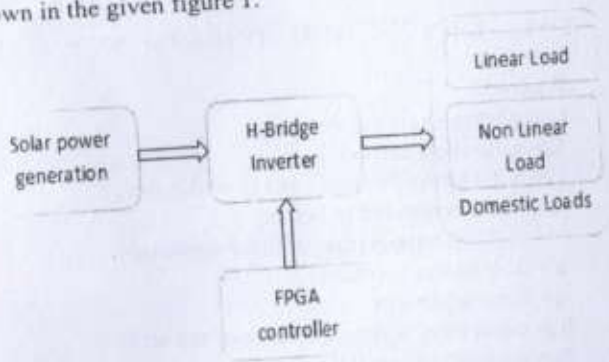

Fig 1. Block diagram of the Proposed system.

Conference Proceeding of
2nd International Conference on Research Trends in Engineering, Applied Science and Management (ICRTESM-2018)
Osmania University Centre for International Programmes, Osmania University Campus, Hyderabad, Telangana State, India
on 23rd September 2018, ISBN: 978-93-87433-40-3

COMPANIONABILITY OF MODIFIED Z – SOURCE INVERTER WITH SOLAR POWER GENERATION FOR A 3Ø-ASYNCHRONOUS MOTOR

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Professor/EEE, Bharat Institute of Engineering and Technology, Hyderabad, India

Vijayalakshmi Yarra[2], **Dhanalakshmi Malothu**[3]
PG Student/EEE, Bharat Institute of Engineering and Technology, Hyderabad, India

ABSTRACT -Among the different types of inverters for the solar power generation, the impedance source (Z-Source) inverter ds a significant role due to its boosting characteristics. Since the source for this proposed work is solar energy, the inverter with pedance will give a sufficient level of voltage for the load. The output of the proposed is given to a three phase asynchronous e of motor, which is commonly used by the farmers in their agricultural pumps. Even though the inverter is working under avy stress due to the output of the Z-Source, necessary filter arrangement is made to get smooth alternate energy for running the tor. The entire arrangement is modeled using MATLAB/SIMULINK and the results are analyzed with the help of THD (Total rmonic Distortion) values of output voltage and current.

KEYWORDS- **Solar energy, Z-Source inverter, asynchronous motor, Total Harmonic Distortion**

INTRODUCTION

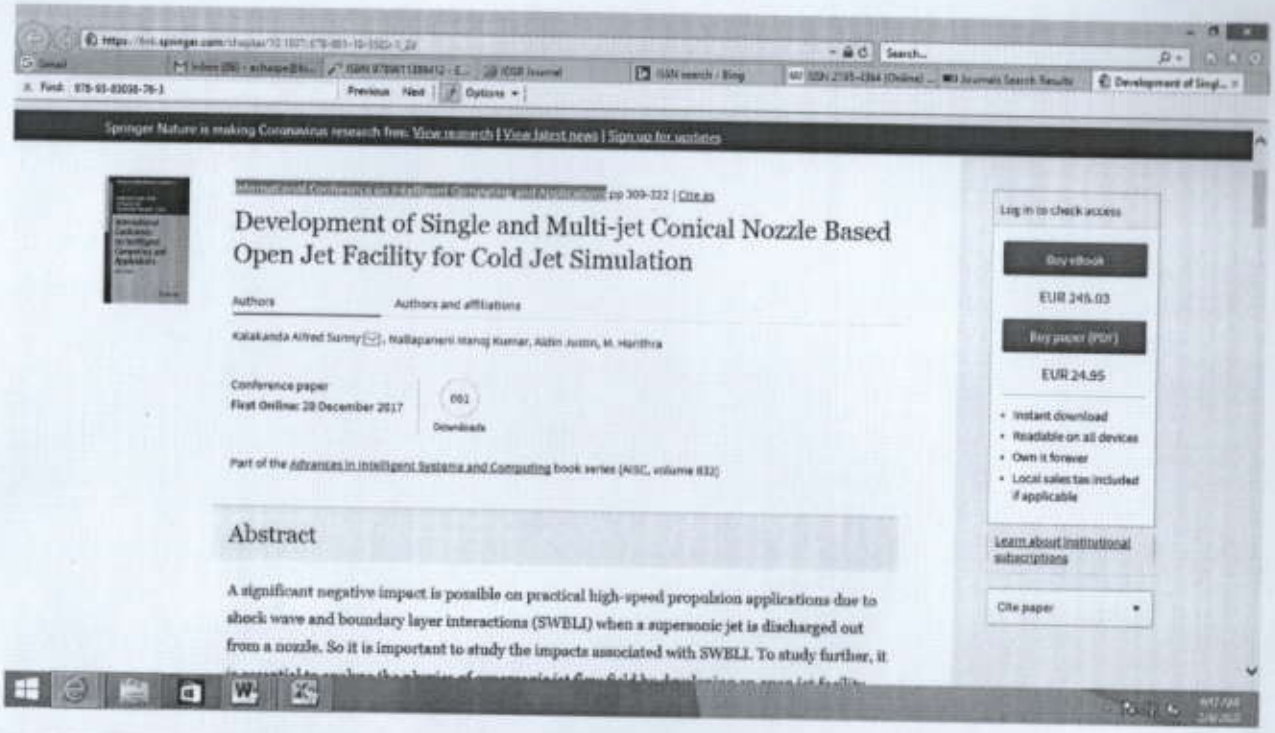
Nowadays the thirsty for power has increased manifold due to the enormous growth in industries and population. But the urces of traditional or conventional power have been drastically reduced and they may be available for four or five decades of re. Also the abundant use of conventional or non renewable energy resources, various environmental problems like air ution, water pollution etc have increased and all become a intimidation for the whole human society. Hence the searching for nate energy has become a timely needed one. Among the various renewable energy sources like solar, thermal, hydro, s and wind energy, the solar energy is the most promising one among them. Solar energy is a radian light and heat from the is harnessed using a range of ever-evolving technologies such as solar heating, photo-voltaic, solar thermal energy, solar re, molten salt power plants and artificial photo synthesis. The large magnitude of solar energy availability makes it a ly appealing source of electricity. The United Nations development programme in its world energy assessment found that the al potential of solar energy was 1600 to 50000 exa joules [EJ]. This is several times larger than the total world energy mption which was 559.8EJ in 2012. The benefits of renewable energy resources reduce the pollution, lower the costs of ating global warming & keep fossil fuel prices lower. These advantages are global. Solar energy has the greatest potential of e sources of renewable energy.

Also the farmers in our country are facing power problem for their agricultural pumping motors moreover in all seasons states. Moreover the price per unit cost of the power also has become a burden for the farmers.

Hence the proposed work aims in harnessing solar energy in a prominent way, which will help the farmers and the onment. In this work, an asynchronous machine is made to run by using solar energy with the help of PWM techniques and a se inverter. The solar energy is dynamic nature, but it is necessary to give a continuous supply for the motor even the solar y is not inadequate. In this work the solar energy generated by the solar panel, is stepped up by using impedance network. ally the Z-source network consists of two inductors and two capacitors. In the modified Z-source network, in addition to apacitor, one capacitor is added parallel to the source. Added capacitor boosts the voltage from the source and also acts as The hardware results are validated with the analysis of total harmonic distortion of output voltage and current of the three inverter.

OPOSED SYSTEM

proposed system with Modified Z-source inverter is shown in figure1.



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Development of Single and Multi-jet Conical Nozzle Based Open Jet Facility for Cold Jet Simulation

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Kalakanda Alfred Sunny, Nallapaneni Manoj Kumar, Aldin Justin, M. Haridhra

Conference paper
First Online: 28 December 2017

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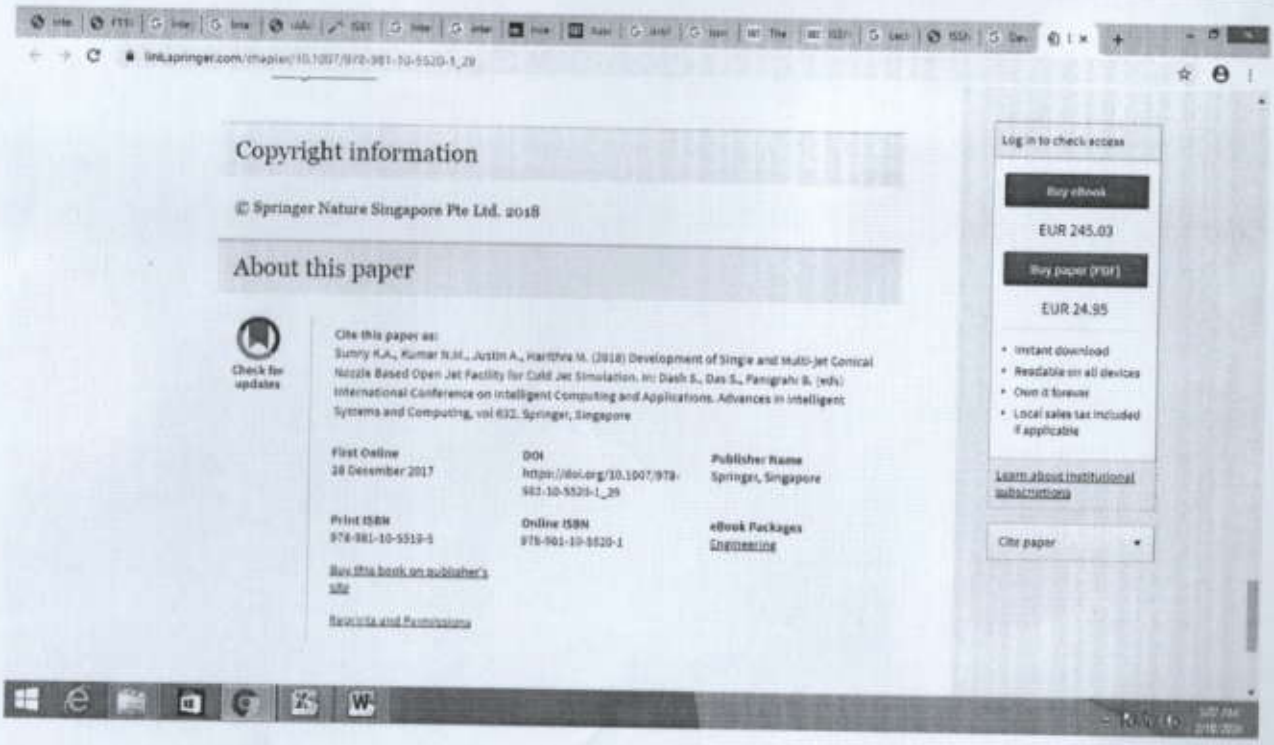
Abstract

A significant negative impact is possible on practical high-speed propulsion applications due to shock wave and boundary layer interactions (SWBLI) when a supersonic jet is discharged out from a nozzle. So it is important to study the impacts associated with SWBLI. To study further, it



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Development of Single and Multi-jet Conical Nozzle Based Open Jet Facility for Cold Jet Simulation

Kalakanda Alfred Sunny, Nallapaneni Manoj Kumar, Aldin Justin and M. Harithra

Abstract A significant negative impact is possible on practical high-speed propulsion applications due to shock wave and boundary layer interactions (SWBLI) when a supersonic jet is discharged out from a nozzle. So it is important to study the impacts associated with SWBLI. To study further, it is essential to analyze the physics of supersonic jet flow field by developing an open jet facility (OJF) in the laboratories. Supersonic jet can be produced in laboratories by allowing compressed air to escape through a nozzle into the atmosphere. Modeling, fabrication, and CFD simulation of nozzle-based open jet facility will help in understanding the supersonic jet flow. In this paper, an open jet facility is developed with single- and multi-jet conical nozzles in the Wind Tunnels Laboratory of Karunya University. The performance of this facility is evaluated theoretically and experimentally based on the runtime at different Mach numbers. Z-type schlieren technique is also applied to analyze the cold jet flow at a Mach number 2. CFD simulation is also carried out to verify the flow pattern that is visualized in experimental process.

Keywords Shock wave · Boundary layer · Shock wave and boundary layer interactions (SWBLI) · Open jet facility (OJF) · Runtime · Mach number Z-type schlieren technique · CFD

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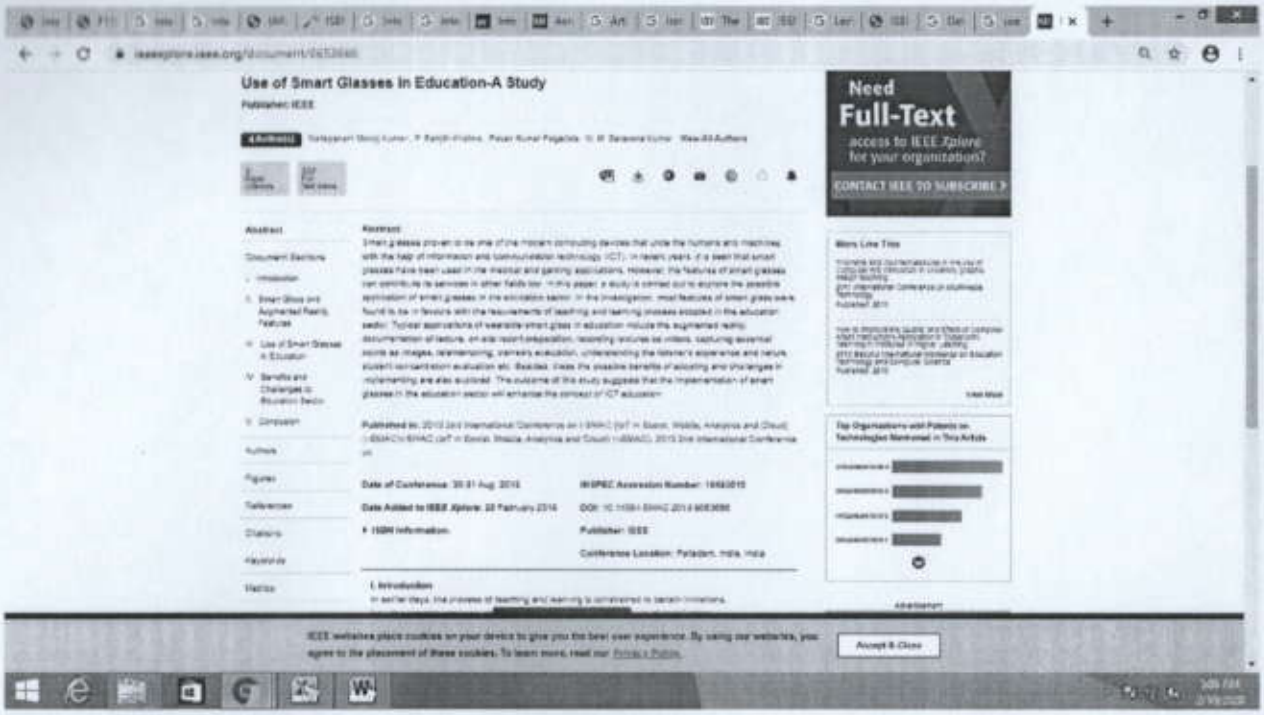
Use of Smart Glasses in Education-A Study
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Use of Smart Glasses in Education-A Study

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***Abstract*—Smart glasses proven to be one of the modern computing devices that unite the humans and machines with the help of information and communication technology (ICT). In recent years, it is seen that smart glasses have been used in the medical and gaming applications. However, the features of smart glasses can contribute its services in other fields too. In this paper, a study is carried out to explore the possible application of smart glasses in the education sector. In the investigation, most features of smart glass were found to be in favours with the requirements of teaching and learning process adopted in the education sector. Typical applications of wearable smart glass in education include the augmented reality, documentation of lecture, on-site report preparation, recording lectures as videos, capturing essential points as images, telementoring, trainee's evaluation, understanding the listener's experience and nature, student concentration evaluation etc. Besides, these the possible benefits of adopting and challenges in implementing are also explored. The outcome of this study suggests that the implementation of smart glasses in the education sector will enhance the concept of ICT education.**

***Keywords*—Smart glass, eyewear devices, HMD's, head-mounted displays, OHMD's, wearable technology, smart glass in education, application of smart glass in education, digital education, google glass.**

I. Introduction

In earlier days, the process of teaching and learning is constrained to certain limitations. Now the learning has been transformed into a new Age with the help of digitalisation. Latest happenings in ICT has reformed the education sector to adapt to the digital learning environment [1].

Use of ICT in the education sector will enhance the teaching and learning process in all aspects. This will also help in smooth functioning of the administrative activities [2]. Researchers have conducted various studies to understand the roles of digital technologies. Various digital tools include computers, projectors, biometric systems, Virtual classrooms and labs, digital data maintenance systems, e-learning, tablets etc. [3].

C. Delgado Kloos et al. presented a study on the educational technology and its roles in reducing the gap between learner and listener and suggested an open learning system where this technology will help the students as well as a teacher in sharing the lecture notes and instruction materials anywhere any time [4]. H. Beatriz Ramírez Moreno et al. presented a study on the use of mobile apps for teaching and learning process especially for the school children [5]. The study shows how the digital technologies including the mobile and information techniques emerged into the education field [5]. A study by R. A. McKinney suggests the use of digital technologies for overcoming the grammar deficits of the students in engineering education [6]. Many studies have been carried out in identifying the roles of digital technologies in education. In recent years a new technology called smart technology has evolved into the market. The innovative product smart glass seems to have potential applications in many sectors, and the same may be applicable to improving the learning experience in education too.

A. The objective of the Study

This paper explores the use of the wearable technology especially eye worn smart glasses in the education system. Based on the features of smart glass, applications were explored. Apart from this, the possible benefits and challenges were also explored.

II. Smart Glass and Augmented Reality Features

Smart glass is one of the intelligent and innovative computing device developed in recent years. Smart glasses convert the transparency nature of the hard glass into the translucent nature [7-10]. It is embedded with several components that include liquid crystal devices, electrochromic, suspended particles, optical head-mounted displays, thermochromic, multiple sensors, photochromic, and processing capability handlers [7-10]. It became more popular with the widespread applications in the medical field as well as the gaming sector etc. [10]. It is one of the wearable devices that typically worn by the human. As Person wears it close to the eye, it is called as an eye-worn wearable device.

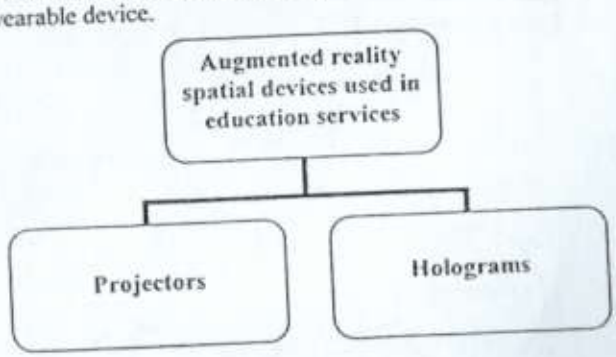
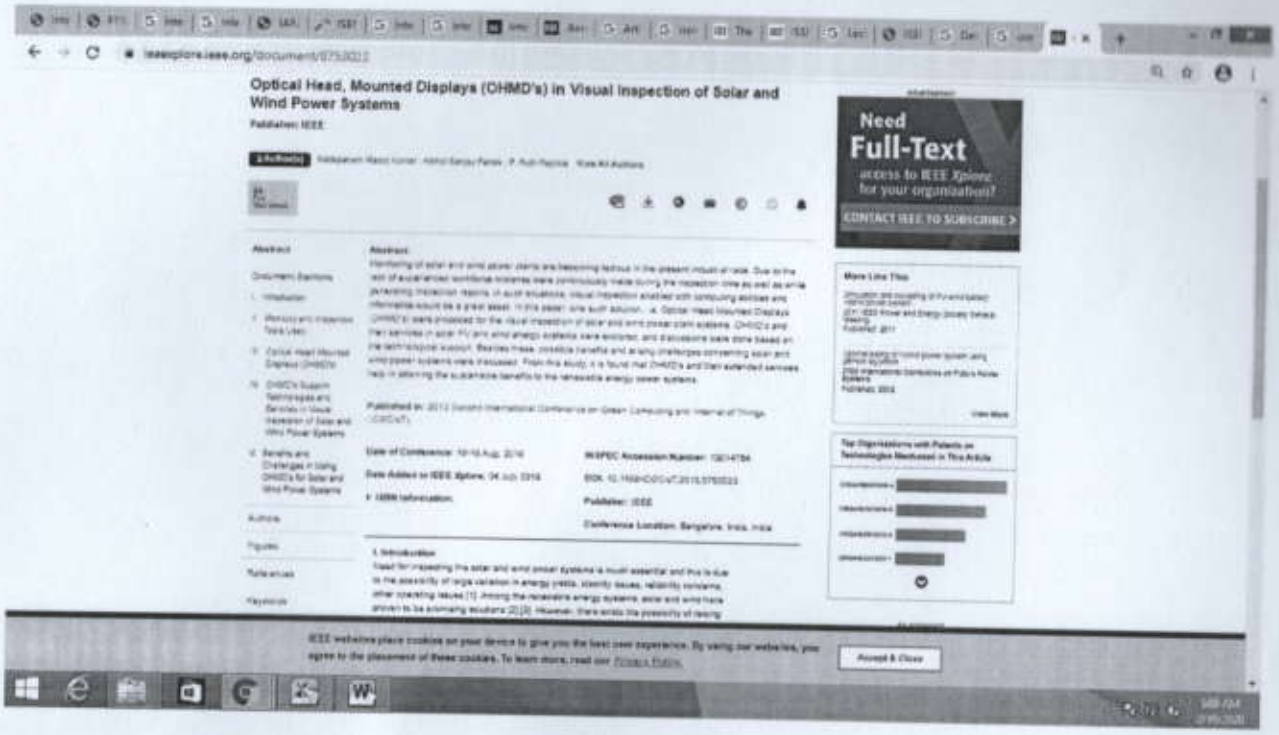


Fig 1. Spatial devices used in the education sector

Apart from this, we have a few wearable devices that look and work in like smart glasses. These include head-worn devices head mounted displays (HMD's), optical head-mounted displays (OHMD's), and optical see-through head-mounted displays (OSTHMD's) [11], Smartphones, Tablets, Smart Watches, Spatial devices like Projectors and Holograms [10, 12-14].

These wearable devices are capable of handling computing tasks that an ordinary person cannot do with the naked eye, with the advancement seen in the electronic technology, communication technology, and internet technologies. In every smart glass, information exchange is


Optical Head, Mounted Displays (OHMD's) in Visual Inspection of Solar and Wind Power Systems
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Optical Head, Mounted Displays (OHMD's) in Visual Inspection of Solar and Wind Power Systems

Nallapaneni Manoj Kumar[†], Abhijit Sanjay Pande[^], P. Ruth Rejoice[†]

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***Abstract*—Monitoring of solar and wind power plants are becoming tedious in the present industrial race. Due to the lack of experienced workforce mistakes were continuously made during the inspection time as well as while generating inspection reports. In such situations, visual inspection enabled with computing abilities and informatics would be a great asset. In this paper, one such solution, i.e. *Optical Head Mounted Displays (OHMD's)* were proposed for the visual inspection of solar and wind power plant systems. OHMD's and their services in solar PV and wind energy systems were explored, and discussions were done based on the technological support. Besides these, possible benefits and arising challenges concerning solar and wind power systems were discussed. From this study, it is found that OHMD's and their extended services help in attaining the sustainable benefits to the renewable energy power systems.**

Keywords*—*Head-mounted displays; Optical head-mounted displays, OHMD's; Optical see-through head-mounted display; OST-HMD; Solar power plant monitoring; Wind power plant monitoring; Visual inspections; On-site monitoring.

I. Introduction

Need for inspecting the solar and wind power systems is much essential and this is due to the possibility of large variation in energy yields, stability issues, reliability concerns, other operating issues [1]. Among the renewable energy systems, solar and wind have proven to be promising solutions [2,3]. However, there exists the possibility of raising concerns relating to operating conditions and corresponding maintenance to be carried. The process of inspection is generally carried out by sending a team of experts or a person physically to the solar or/and wind power plant sites. Here, the person in charge will carefully follow the inspection guidelines and monitor the solar or/and wind power plant operating conditions. Based on the outcomes of the inspection report, decisions were made on conducting the maintenance issues. In this process, the inspection team, decision-making team, approval team etc. are involved, and the process is quite tedious and takes a long time. Such situations are quite common in solar, and wind power systems as their performance are more inclined towards the weather conditions as well the technology used [4-6]. This process even becomes more complex and worst in executing in large-scale solar and trunky wind power projects. In such cases, automating the inspection process using communications and information systems would be a better solution. In these situations, the recently emerged technology, i.e. *Head Mounted Displays (HMD's)* seem to be one of the promising solutions in addressing the inspection issues. The development of HMD's is further taking one step advanced in improving the working features with the addition of optical lenses, making the HMD's into Optical Head Mounted Displays (OHMD's). HMD's or/and OHMD's offers the unique feature of visual inspection and monitoring abilities with the incorporation of speech technology, image and video capturing technology. The special features of OHMD's enable the more accurate inspection with visual proof [7]. The objective of this paper is to study on the possibilities of visual inspections using optical head-mounted displays in the solar and wind power plant systems. As per the author's knowledge, it is first of its kind article to propose the OHMD's for visual monitoring of renewable energy power systems. Various services offered by OHMD's in the focused area, possible benefits and challenges were explored.

The article is divided into six sections: section-II deals with the various monitoring tools used for the solar and wind power plant inspections. In section-III, a brief study on the optical head-mounted displays is made. Section-IV discusses various technologies that are embedded with optical head-mounted displays and the OHMD's services offered in solar and wind power plants. Section-V highlights the benefits and challenges of applying OHMD's in solar and wind power plants. Eventually, the article is concluded in section-VI, highlighting the OHMD's contributions.

II. Monitory and Inspection Tools Used

Monitory methods or inspections adopted in solar and wind power plant systems were studied in this section very briefly. In earlier days, the inspection of power plants was done by frequent visits to the sites. During the visit, the inspection team members will survey as per the predefined log file formats. Most inspections are visually noted in the log book; then the meeting would be conducted to discuss the possible actions to be taken for improving the performance of the power plant. In this type of inspections, the time taken for troubleshooting will be more, and other would be possible human errors in sharing the information, or while making a note of monitored data [1]. With the advancements in data recording systems, the inspection and monitoring process has become a bit easier by eliminating handwritten log files. Data loggers help in collecting the data of any system with some physical connections [8]. Eventually, the process of monitoring has taken a new shift allowing users to have remote monitoring of power plants using PLC, and SCADA [9]. This is due to the progress seen in data acquisition systems and communication devices.

In the recent years, new technology has evolved, i.e. Internet of Things, which made the process of monitoring much more accessible [10]. Monitoring of power systems with IoT allows more accuracy, time to time maintenance etc. [11,12]. The IoT architecture system can be modified based on application area and handling functions [13]. However, there exist few challenges with IoT systems, these include the security and privacy issues. For addressing the monitory matters, a new version of IoT devices with blockchain enabled services were introduced [14].

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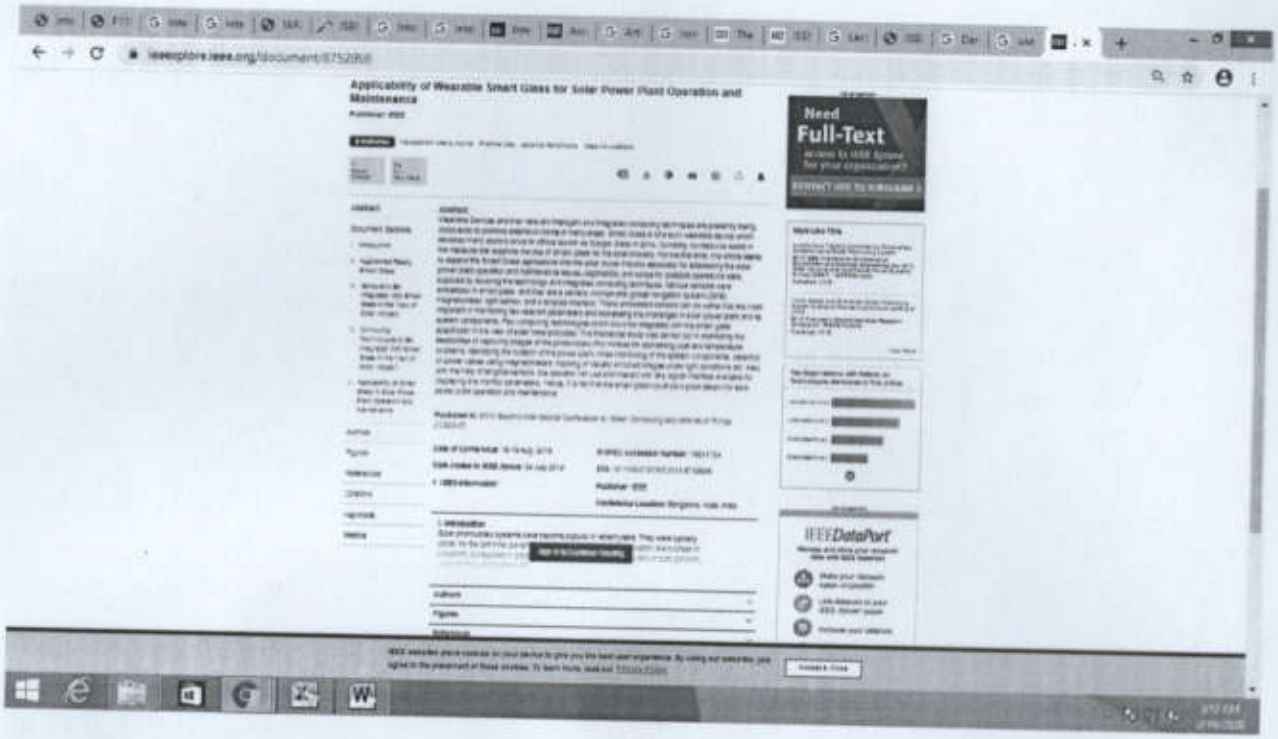
Applicability of Wearable Smart Glass for Solar Power Plant Operation and Maintenance
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Applicability of Wearable Smart Glass for Solar Power Plant Operation and Maintenance

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***Abstract*—Wearable Devices and their relevant intelligent and integrated computing techniques are presently being discovered to promote extensive claims in many areas. *Smart Glass* is one such wearable device which attracted many sectors since its official launch as Google Glass in 2014. Currently, no resource exists in the literature that supports the use of Smart Glass for the solar industry. For the first time, this article seeks to expand the Smart Glass applications into the solar power industry especially for addressing the solar power plant operation and maintenance issues. Applicability and scope for possible operations were explored by studying the technology and integrated computing techniques. Various sensors were embedded in smart glass, and they are a camera, microphone, global navigation system (GPS), magnetometer, light sensor, and a tangible interface. These embedded sensors can do works that are most important in monitoring few relevant parameters and addressing the challenges in solar power plant and its system components. Few computing technologies which could be integrated with the smart glass specifically in the view of solar were proposed. The theoretical study was carried out in monitoring the feasibilities of capturing images of the photovoltaic (PV) module for addressing dust and temperature problems, identifying the location of the power plant, noise monitoring of the system components, detection of power cables using magnetometers, tracking of visually enriched images under light conditions etc. Also, with the help of tangible sensors, the operator can use and interact with any digital interface available for displaying the monitor parameters. Hence, it is felt that the smart glass could be a great assent for solar power plant operation and maintenance.**

***Keywords*—Smart Glass, Solar Power Plant, Augmented Reality in Solar, Smart Glass Application in Solar, PV Module Image Capture, Smart Glass as Monitory Device in Solar.**

I. INTRODUCTION

Solar photovoltaic systems have become popular in recent years. They were typically driven by the technical advancements seen in the industrial production, the process of utilisation, a decrease in production cost, awareness in the public and private partners, support from governments [1].

Solar energy is freely available, and anyone can harness it depending upon their application [2-4]. Solar energy can be used in different ways especially for power generation, and water heating [5]. There are other applications of solar energy also. But the most commonly seen solar energy conversion systems are photovoltaics [6-8]. Photovoltaics converts the radiant solar irradiance to DC electricity, and from there, it is converted into useful AC with the help of power converters [9]. In recent years, the cost of the solar photovoltaics had reduced, and this led to huge markets. Economically, technically the solar PV seems to be more viable [10]. On the other side, solar power plants have seen various mounting schemes like roof integrated [11], open rack [12], building integrated etc. [13]. In every mounting configuration, PV systems showed a better performance. However, irrespective of the installation and mounting configurations the operation and maintenance issues are common. Sometimes, these issues might be complicated in a few installation approaches.

In literature, many methods were proposed for addressing the operating and maintenance issues. The first and foremost method of operation and maintenance is through physical inspection by conducting regular field visits to the solar power plant site. Here, the in charge person would monitor the condition of each component. According to the problem identification, troubleshooting is done. In recent years, for addressing this issue, new trends have been proposed. The proposed methods include the use of advanced computing tools [14] and robotic [15]. Data acquisition systems played a prominent role in monitoring various operating parameters [16], later the monitored parameters are analysed using statistical and other computing tools to investigate the actual impact on solar PV plants energy performance. With the advancements in sensor technology and communication technology, the Internet of Things has become most trending in monitoring the solar power plants [17,18]. Few works highlight the use of intelligent systems like recognition technologies, artificial intelligence, and machine learning for addressing the issues in solar [19].

Intelligent systems were seeming to have better opportunities than to the conventional methods. Recently, in 2014 Google has launched the augmented reality (AR) wearable smart glass [20], which is more intelligent and its implication in solar is explored.

Objective of this paper is to study the applicability and possibilities of using augmented reality (AR) smart glasses for solar power plant operation and maintenance. Various sensors and technologies that are to be integrated with the smart glasses are explored here concerning the solar power plant.

The article is divided into six sections, where the section-II deals with the basic information of smart glass and its features concerning embedded sensors. Section-III explains about embedded sensors in smart glass keeping the solar power plant as a study area. Section-IV studies the on computing technologies to be integrated with smart glass for solar power plant monitoring application. Section-V discusses the AR smart glass applicability and how it enables

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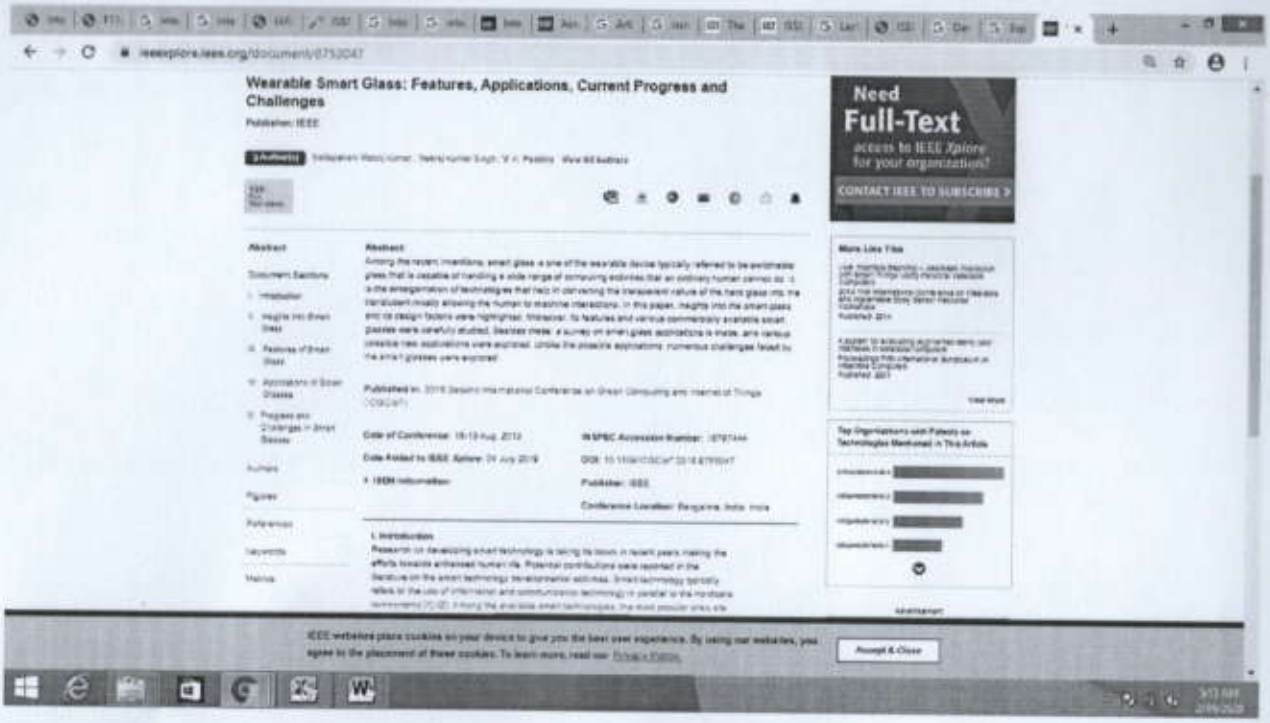
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Wearable Smart Glass: Features, Applications, Current Progress and Challenges

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***Abstract*—Among the recent inventions, smart glass is one of the wearable device typically referred to be switchable glass that is capable of handling a wide range of computing activities that an ordinary human cannot do. It is the amalgamation of technologies that help in converting the transparent nature of the hard glass into the translucent mostly allowing the human to machine interactions. In this paper, insights into the smart glass and its design factors were highlighted. Moreover, its features and various commercially available smart glasses were carefully studied. Besides these, a survey on smart glass applications is made, and various possible new applications were explored. Unlike the possible applications, numerous challenges faced by the smart glasses were explored.**

Keywords*—*smart glass, wearable technology, head-mounted displays, wearable device, switchable glass, augmented reality, applications of smart glasses, virtual reality, smart glass applications, smart glass features, challenges in the smart glass, smart glass design factors.

I. Introduction

Research on developing smart technology is taking its boom in recent years making the efforts towards enhanced human life. Potential contributions were reported in the literature on the smart technology developmental activities. Smart technology typically refers to the use of information and communication technology in parallel to the hardware components [1-3]. Among the available smart technologies, the most popular ones are a smart-watch, smart glass, smart jacket, smart fabric, smart fashion, smart gaming devices etc. [4]. Wearable smart technologies were recently expanded into many areas, especially the industrial, gaming, and medical sectors in solving issues. The reason for this is the need for active data collection, processing, decision making in executing the task [5]. As a part of this, machine to machine (M-M), human to machine (H-M) interactions became more popular by overthrowing the human to human (H-H) interactions.

When we see these three interactions, i.e. M-M, H-M, and H-H, we find many differences in the use of technology to achieve the objective, use cases, and product development. In M-M, the interactions will happen between two or more machines mostly eliminate the need for humanitarian interventions. Mostly, this would happen with the digital and autonomous controlled devices or products. In H-M, the interactions will happen between the human to machines, allowing the human workforce to deliver some instructions in carrying out the task. Whereas in the case of H-H, all the instructions are possible between the workforce. Among the three, the most adopted one in present scenarios is the H-M. With this, research on developing the products and services, exploration and adoption of its use related to the human to machine interactions were being carried out [6].

Hence, studying the concepts like communication technologies, information technologies, and their associated technologies possible in human to machine interactions are more important. Smart and wearable devices like smart glasses which relate to the above fields can be given more importance. As per the understanding, they seem to have special features that would help in improving the human workforce capabilities. But how far the use of smart glasses would be, where and in which sector these smart glasses can better fit etc. were still being explored.

The study presented in this paper focuses on the insights into the smart glass with a concentration made on the available commercial smart glasses, design factors on smart glass, features, applications, progress and the challenges. In short, this study aims to explore the applications and challenges of augmented reality based smart glass.

II. Insights into Smart Glass

Smart glasses come under the smart device category mostly used for handling the tasks related to human to machine interactions. Here, in this section, the insights into the smart glasses were explored concentrating on smart glass products, smart glass components, embedded technologies, and design factors.

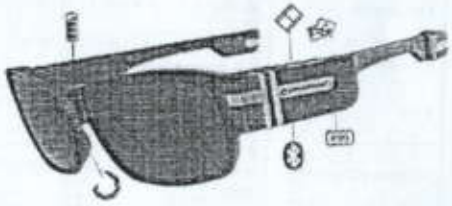

Fig. 1. Smart glass indicating its features [7] (Source: Smart Vision Labs)

A. Smart Glass and Its Components

Smart glass is one of the types under the head-mounted displays (HMD's). Smart glass is a smart wearable device that brings up the wearers, computing facilities, and clients together for handling the most complex task in a simple manner [8]. With smart glasses, the available information at the work site is easily transferred to the controlling and central or distributed monitoring stations. The process of information exchange, information sharing is done very quickly and even can be stored for future reference. Fig. 1 [7] Shows a typical smart glass along with its features. As per the smart glass is shown in Fig. 1., it has features like Bluetooth, focus camera, onboard battery power, memory storage device, photo and video viewer display, microphone, magnetometer, GPS etc. [9-11]

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Electrical Evaluation And Quotation Of An Edifice

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ABSTRACT

Electrical estimation is necessary to know the required material and the cost to be incurred on it before starting a new work because it gives us certainty about the amount of money required, availability of material etc. Work started without the estimating and costing, the work cannot be completed because it is very difficult to continue the work due to an instantaneous shortage of money or unavailability of materials. To overcome, by preparing a detailed report on electrical estimation and costing of materials

The main and important task involved in executing this paper as a case study is to estimate the electrical equipment (load) for various Rooms in a building, which includes electrical wiring, conductor sizes, protective devices and cost estimation by implementing with a software, by considering the standards, rules such as IE rules (Indian Electricity rules) with latest acts, BEE etc. which is use full for future and gives fruitful results.

Key Words: *electrical estimation and costing, java software.*

1. INTRODUCTION

Estimation gives approximate materials, investment involved and the time to be taken for completion of electrification planning to do.

Estimating the material cost and the time required for completion of the work can help in making a right and firm decision while making a contract with any firm. The job of the estimator is interconnected with different aspects of estimation such as enlisted under following three headings:

1. Estimating the quantity of materials (wire size, length, and the cost involved).
2. Analysis of cost/price.
3. Maintaining proper accounts.

2. PURPOSE OF ESTIMATING AND COSTING

It is necessary to know material to be used and the cost to be incurred on it before starting a new work. Hence it is very necessary to make a complete report which will acts as a guide in the successful implementation of work. It includes a complete knowledge of the work to be done such as drawing of the work, complete details of the necessary material with its cost and the sequence of operation to be performed.

Estimating is also necessary because it gives us certainty about the amount required, availability of materials etc. the work cannot be completed successively because it becomes difficult to continue the work due to instantaneous shortage of money or unavailability of material.

For purchasing the materials according to estimating and costing, marketing survey is necessary. The estimating and costing have following aims:

a) To ensure that the list of materials is completed before starting the job so that there are very low chances of a shortage of any necessary materials after starting the work.
b) To ensure that the money is not misused in the work under implementation.
c) The time is saved i.e., the work is completed well in time as planned.

The following problems can come in the way of the work started without estimating and costing:

a) It becomes very difficult to purchase when materials are not listed due to which the work is not continued successively.
b) The money is misused by purchasing smaller or excess quantities of materials from the market due to which the shortage of money can cause the stoppage of work in midway.
c) Due to above-mentioned hurdles, the work can take more time for completion and it can affect the other existing work.

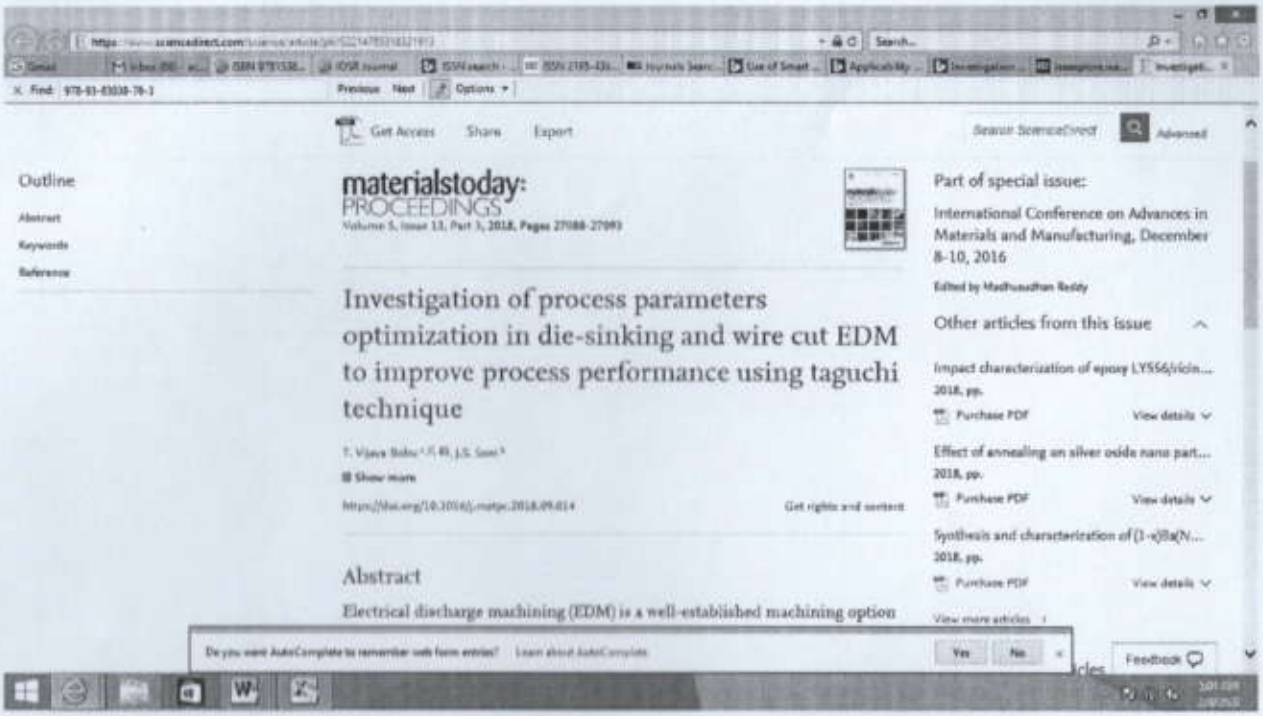
Hence, for completion of work within time limit and without misuse of money, it is necessary to do estimating and costing prior to starting any work. For electrification of any building, estimating and costing is necessary. The estimator will make the complete planning of electrification including designing of wiring, the location of points and finally prepare a complete estimating and costing report. After the purchase of material according to the estimating and costing report, the work should be completed under the supervision of some qualified or permit-holder engineer.

3. Essential Elements Of Estimating And Costing

Before any electrical work is initiated, the knowledge of materials required for that work and the estimate and cost involved is essential while preparing design details and the list of material required for that work. The estimator should also know the following details:

1. Specification of materials.
2. Latest market cost of materials.
3. Net Price list.
4. Calculation of materials and labor cost.
5. Knowledge of purchase system.

4. Size & Current Carrying Capacity Of A Wire



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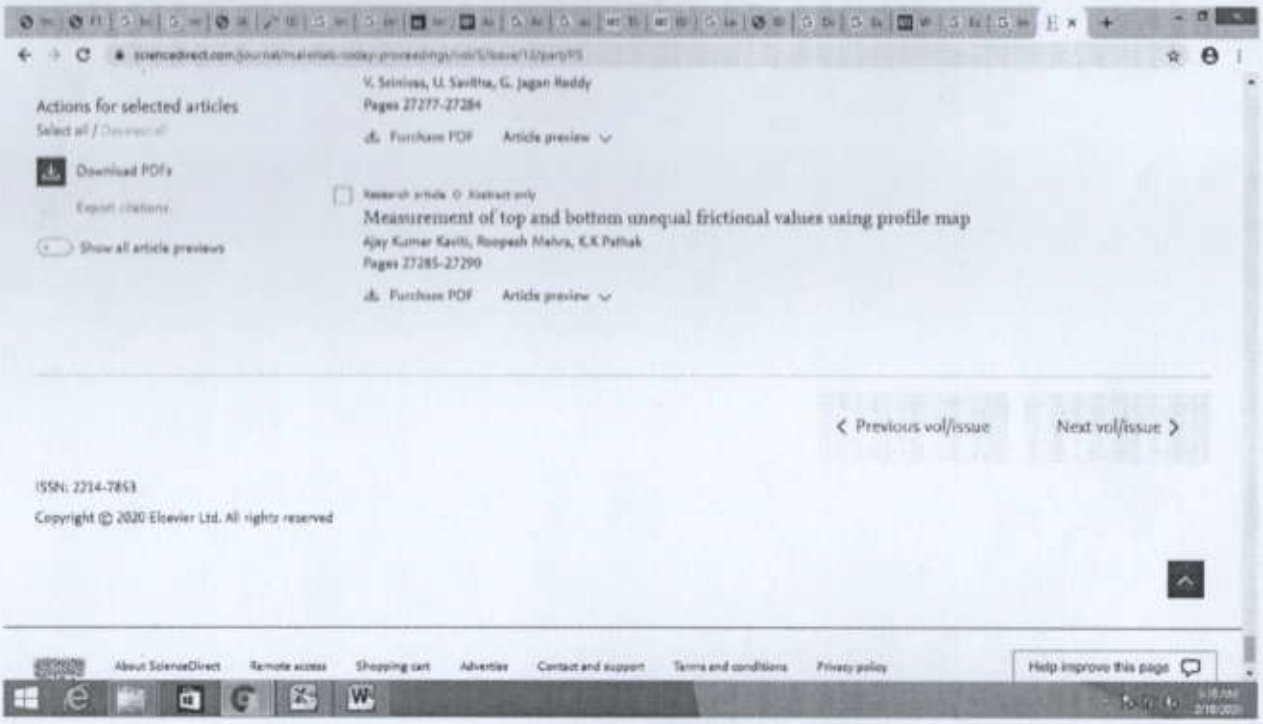

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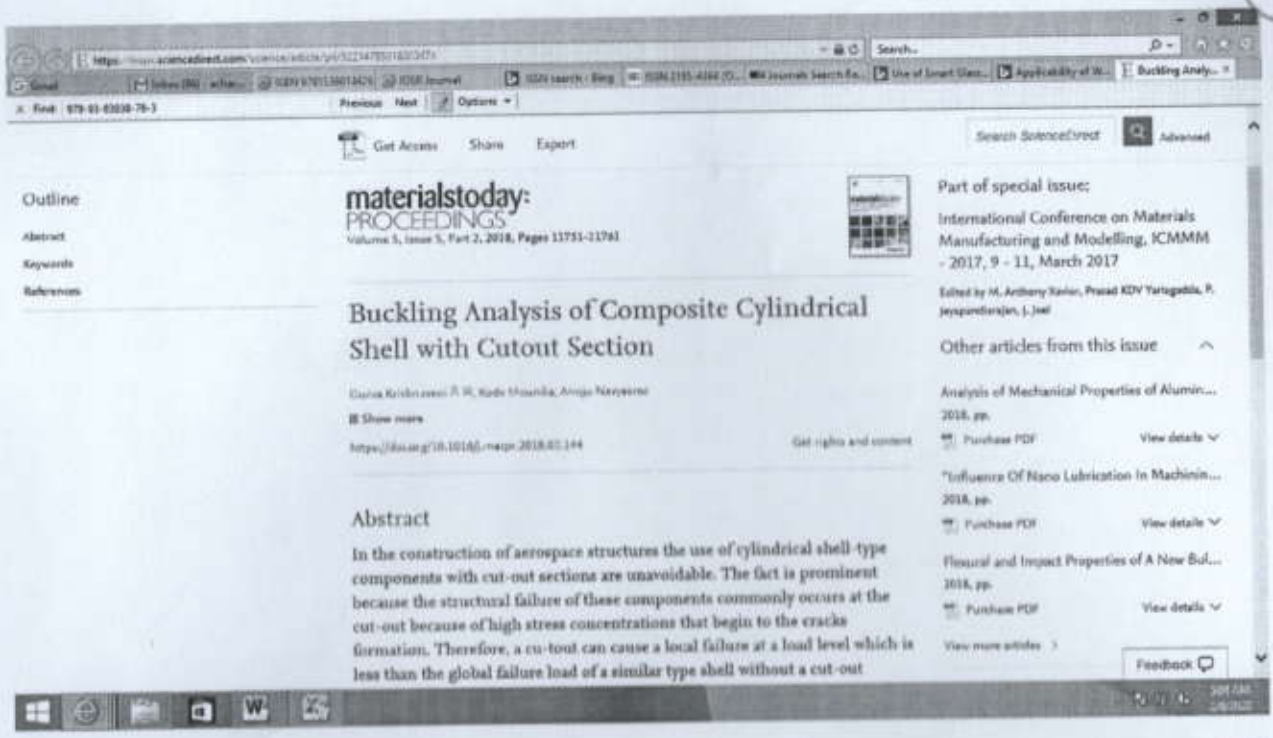

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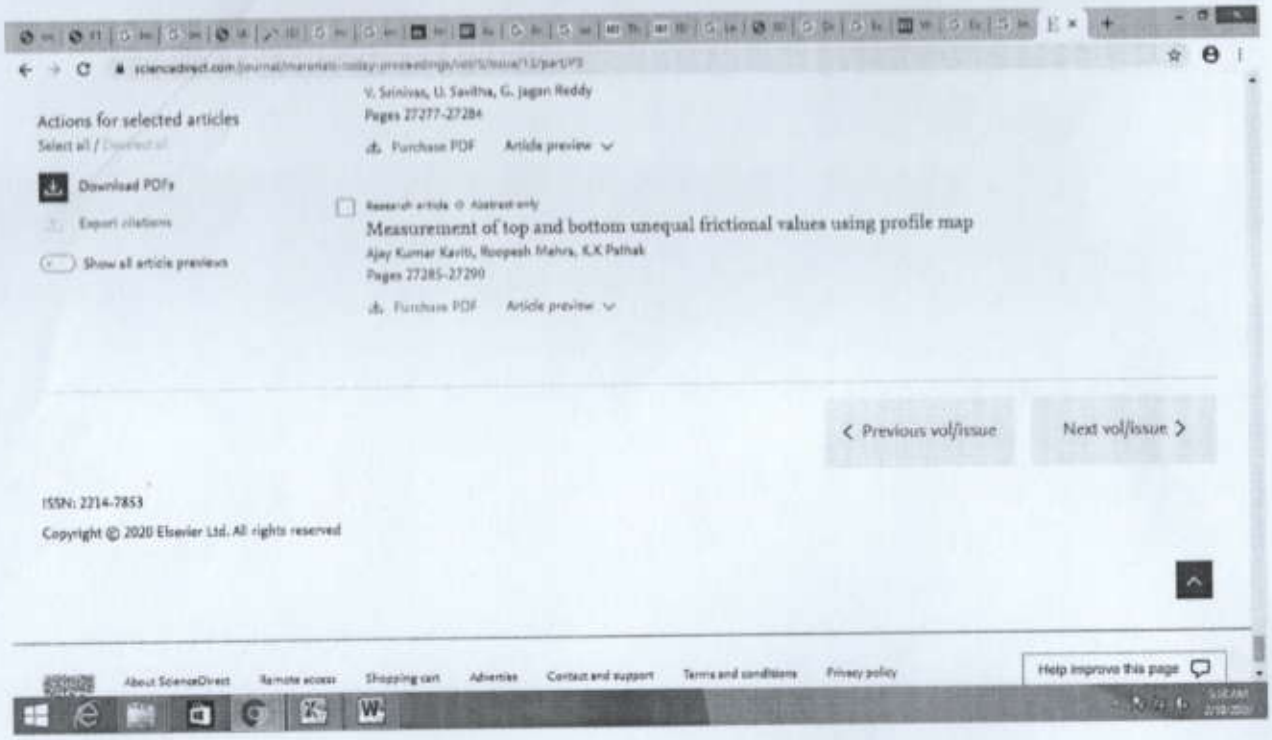

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ABSTRACT-The revolution of wireless communication, portable and mobile devices has consistently demanding the designer to design the device for low power consumption. Power loss becomes a main parameter of integrated circuits, particularly for portable computers and personal communication systems. There has been consistent research and development to improve the power consumption and performance of the device in various level of abstraction starting from mask layout – circuit, Gate and Register level- to system level. Various approaches including hardware and software are identified to design the VLSI Circuit with minimum power consumption and optimization between the power and performance. This paper analyzes the main source of power indulgence in CMOS circuit & their impact.

KEY WORDS: *Static dissipation, Dynamic dissipation, Power-Delay.*

1. INTRODUCTION

Methods: The CMOS control liberalities are static and dynamic. At the point when there is no change in rationale. Dynamic power dispersal happens when there is a change of rationale from high to low or the other way around. Primary wellspring of intensity liberality in chip is because of dynamic power liberality. The dynamic power is dispersed through charging, releasing of capacitance.

With coming in semiconductor innovation particularly over the most recent couple of years there has been extraordinary upheaval in the field of data and innovation. Several million of transistor are created in a solitary chip. In the meantime the intricacy in outlining, testing and manufacturing the chip has additionally expanded. The real stress for the fashioner currently is to upgrade the power utilization without corrupting the execution.

Dynamic power dissipation is summation of P-switching & S-short-circuit.

Pswitching = a f Ceff .Vdd^2

Sshort-circuit = Isc .Vdd.f.

We introduce the CMOS inverter and observe the various parameters and their impact in power dissipation.

CMOS Inverter:

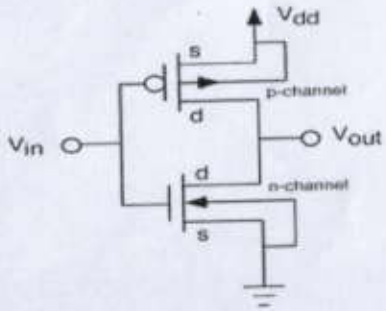

Figure.1. CMOS Inverter

Observation of key parameters and their impact on power and delay for cmos inverter are purposed below based on simulation

Clock frequency and its impact on power dissipation: The fundamental dynamic power dissipation equation **P= αCV^2F** shows that the power dissipation depends on load capacitance clock frequency and supply voltage. An experimental setup fig (2) to show a linear relation between clock frequency and the power consumption is carried out. We

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Performance analysis of 100 kWp grid connected Si-poly photovoltaic system using PVsyst simulation tool

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Abstract

This paper analyzes the simulated performance of 100 kWp grid connected Si-poly photovoltaic system. This study was conducted to evaluate the feasibility of installing a photovoltaic system for supplying the electric load of an educational institute. The simulated system comprises 323 Si-poly PV modules. Each PV module has a rating of 310 Wp. All the PV modules are arranged in 17 strings, with each string made up of 19 modules in series. Four solar inverters, each having a rating of 20 kW are used for interconnecting with the grid through a utility meter. The simulation is carried out using PVsyst V6.52 software. Meteonorm 7.1 weather data sets of solar radiation and ambient temperature from the PVsyst database has been utilized for this analysis. The simulation results were analyzed for assessing the performance of the photovoltaic system. This includes evaluating the effective energy output of the PV array, energy injected into the grid, performance ratio and other normalized energy productions per installed kWp. The 100 kWp PV system generates 165.38 MWh/year, out of which only 161.6 MWh/year is injected into the grid. The annual performance ratio is around 80 % and the normalized productions of inverter output or final system yield i.e. useful energy is 4.42 kWh/kWp/day. Finally the loss diagram over the whole year is also computed.

Peer-review under responsibility of the scientific committee of the 1st International Conference on Power Engineering, Computing and CONtrol.

Keywords: Solar energy; grid connected photovoltaic system; PVsyst simulation tool, Si-poly PV Module; performance ratio.

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A Strategic Markov Approach for Reliability Assessment of Engineering Systems

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Abstract: Since a long period, Markov models and Markov analysis methods were consigned to do that list of peculiar but rarely used stochastic modeling techniques, at least for reliability and maintainability purposes. The proclamation of IEC standard 61508 Functional Safety of Electrical/ Electronic/ Programmable Electronic Safety – Related systems has well rejuvenated Markov analysis by requiring the analysis of various distinct failure modes from a safety perspective. The methods also are receiving significant attention because today's software tools make computationally complex Markov analyses effortless to perform than in the past. In this paper Markov analysis is done to predict reliability of four test systems by using Isograph Reliability Workbench 13.0 tool.

Keywords: Availability; Reliability; stochastic; Markov approach.

1. Introduction

The Reliability theory is a new scientific discipline which deals with the general regularities to be observed in the design, experimentation, manufacture and use of system to obtain maximum efficiency of the systems. The need of obtaining highly reliable system has acquired special importance with the development of the present-day technology. A complex system becomes unreliable due to various reasons. The principal causes of unreliability are design, unknown environmental conditions, lack of capacity of parts and equipment. As a matter of fact, failure plays a vital role in the realm of reliability.

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EXPERIMENTAL EVALUATION OF THE INFLUENCE OF PROCESS PARAMETERS ON SURFACE ROUGHNESS IN COMPONENTS PRODUCED BY 3- D PRINTING (F D M)

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Abstract— Fused Deposition modeling (F D M) is an Additive Manufacturing Technology in which components are produced by adding of material by layer wise fashion. It is also called as 3- D Printing Technology and Rapid Prototyping process, and it consumes very minimum time for the production of any complex component just by creation of CAD model in the computer. There are numerous practical applications for 3- D Printing Technology in various fields such as Aerospace Technology, Defense sector, Automobile Industry, Ship building factories, etc.,. A B S plus thermoplastic material is used in the Fused Deposition Modelling Technique (FDM), which is supplied in wire forms and squeezed into the required product by the heated nozzle controlled by the CATALYST software. By the combination of process parameters such as model interior, build orientation angle, and direction of rotation using Taguchi L 9 method, a prototype of specimen is modeled using CATIA V 5 and fabricated by Dimension 1200 E S model 3- D Printing machine. The Surface Roughness test is carried out by using Mitutoyo Surface Roughness Tester. Experiments are conducted on 3- D Printing machine by varying the Model Interior, Build Orientation Angle and Direction of Rotation. All the 27 fabricated test specimens are tested for Surface Roughness. The optimum parameters of Model Interior, Direction of Rotation and Build Orientation Angle are obtained after conducting experiments on the 3- D Printing machine.

Keywords—3-D printing;F D M, Model Interior, Direction of Rotation, Build Orientation angle, Catalyst Software, Catia V 5, Surface Roughness.

I. Introduction

For Product development, digital prototyping is widely used by many manufacturing organizations in the recent times, in different areas. The main challenge comes after the product has been digitally prototyped, and tested for the real world, under virtual conditions; and then in the manufacturing of the real prototype. There are many challenges such as maintenance of sufficient levels of the limits, fits, tolerances, time and costs (tooling design and manufacturing), time for producing the component for the first time. For the purpose of prototyping, 3- D Printing technique is being used in the present days. This method is also called as Additive Manufacturing process or Rapid prototyping.

In this process, addition of material is used in order to build the machine component, which is under manufacturing. There is no metal cutting and associated chips production in 3- D Printing process. In this method, the required complex shaped components are modeled using CAD software and stored in .stl file format, which in turn is loaded into the 3- D Printing machine. The required components are fabricated automatically with materials like ABS plastics. In the process of adopting 3- D Printing Technology, Fused Deposition Modeling is one of the important processes that is being currently used by many Industries and Research Institutes for the purpose of developing the prototypes for the first time to ensure their designs, to follow the manufacturing considerations, and to test the components in the laboratory under a large number of conditions.

In this F D M process, one of the important considerations is to evaluate the quality of surface finish of the fabricated components. The process parameters show significant effect on the finished product to meet the market standards. The accuracy of the component is directly dependent on the quality of the surface and also indirectly affects life time of the component in long run. The F D M process is shown in Fig 1.

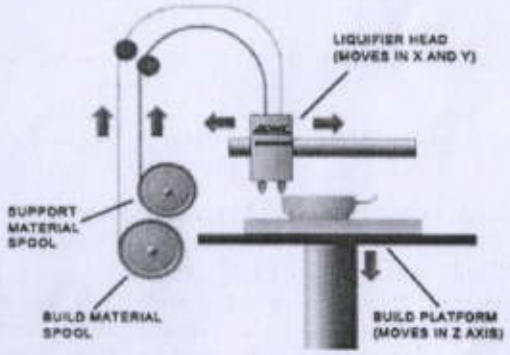

Fig. 1. F D M Working Principle.

.II. Statement Of The Problem

Surface topography of the fabricated component by Fused Deposition Modelling process depends on the process parameters availability at the machine. Optimum selection

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NCIAME / P035

OPTIMIZATION OF SHEAR SPINNING PARAMETERS FOR PRODUCTION OF SEAMLESS ROCKET MOTOR TUBE BY TAGUCHI METHOD

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ABSTRACT

The thin walled seamless, high precision tubes are produced by progressive, continuous localized deformation (shear spinning).. The present experimental work, "Optimization of Shear Spinning Parameters and Production of Seamless Rocket Motor Tube by Taguchi Method", is performed at B D L, Hyderabad, on flow forming machine. Rocket motor tube is used as a pressure vessel in various missiles. It encases propellant and plays a vital role in missile thrust technology. The tube is supposed to withstand high temperature and pressure and should have high mechanical properties. The aim of present research is to establish optimum process parameters like roller radius, stagger, hardness and feed to produce precise mean diameter in reverse shear spinning rocket motor tube for pressure vessel application in aerospace engineering and missile technology with minimum cost of experimentation by Taguchi method. The material chosen for study is SAE 4130 Steel. Ovality of the tubes, mean diameter, surface finish and thickness variation were also studied and it is found that feed rate is 50mm/min for the final pass to flow from the SAE 4130 Steel for obtaining better geometry, thickness and mean diameter.

1. INTRODUCTION:

Flow forming technology has emerged as the most advanced metal forming technique due to its manifold advantages over conventional metal forming techniques such as extrusion and tube drawing. Flow forming, an advanced form of metal spinning, has been used for over 40 years in the military and aerospace industries. The process has found an increasing demand in commercial applications in the aviation, electronics and defense industries where the following features are needed: hollow symmetrical shapes with relatively close tolerance control, variable wall thickness and profile, improved tensile strength and superior surface finishes. Flow forming has spread widely since 1950; initially thick based sauce pans were produced to be used on electric cookers. The experience gathered showed that this technique could also be applied for different branches throughout industry. For some time it had been kept in the background due to the difficulties in recruiting labour. Since muscle power needed to carry out the process and hence was confined for long time to the processing of soft materials, such as non-ferrous metals. However, it soon developed again with the introduction of hydraulic machine with copying attachments, which can be operated by unskilled labour. For certain deformation metal spinning is superior to all other possible methods irrespective of the quantities involved. Modern spinning machines provide high forming forces. These machines helped in processing of stronger materials such as steels, light, medium, and even heavy gauge material and cast, forged or machined preforms. Mechanization of the spinning process has led to the evaluation of flow turning and flow forming. This chip less metal forming technique has gained increasing importance especially over the past two decades.

This forming technique offers significant advantages in comparison with conventional production techniques. Such as spinning, deep drawing, rounding circular bodies with subsequent welding etc. These advantages are particularly pronounced when components are to be produced in small or medium size batches due to relatively lower tooling costs that other process such as deep drawing, the other advantages are:

- Low production cost. Highly Precise, seamless construction to net shapes
- Improved mechanical properties, Tubular, conical & contoured geometry Uniform axially-directional, and stable grain micro structure.
- Very high diameter-to-length ratio, Repeatable accuracy part-to-part & lot-to-lot
- Very little wastage of material, excellent surface finishes, accurate components.

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Design and Fabrication of Multi-Functional Elevator

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ABSTRACT

Generally an elevator is defined as Lifting device consisting of a platform or cage that is raised and lowered mechanically in a vertical shaft in order to move people from one floor to another in a building. The function of this kind of elevator is simple and we found these elevators in working everywhere in the modern society. Here the concept is very different, in addition to the normal function, a special feature is incorporated in the system such that the machine carries the people in horizontal direction also, which is quite useful for many groups of people to cross the busy roads. People like physically handicapped, old aged people, and children's can utilize these types of elevators.There by this project work is taken up and decided to construct one prototype model, to prove the concept practically By using a simple telescopic slide guide ways on which elevator cabin moves and motors for mechanical movements for vertical and horizontal motions of elevator cabin.

Keywords: **Micro Controller(ATMEL 8951) , Linear Telescopic Guide ways, 12V DC Motors, Relays, Limit switches .**

I.INTRODUCTION

Elevators play an important part of our daily lives. But almost all elevators world wide, more than 99% they are in use today are designed to carry the people in vertical direction. Only few elevators designed for special purposes can move in different directions, the hidden technology involved in these elevators is not popular, there by this project work is taken up to high light this technology. To prove the concept practically, a proto type module is constructed using simple technology for the live demonstration. The main objective of the project is to develop a hardware prototype and software to simulate the multi-functional elevator system, which is quite useful for the people for crossing the railway tracks at railway stations.and for crossing the busy Roads.

In 1853, American inventor Elisha Otis showed the world a safe machine powered elevator. The Otis Company started manufacturing elevators in 1861 that were steam powered

II.EXPERIMENTAL SETUP

The major components of the "Multifunctional Elevator" are Linear telescopic guide ways for vertical and horizontal motion of elevator cabin , Gear reduction mechanism for converting rotational motion into linear motion -rack and pinion mechanism, 12V DC Motors , Relays for guiding motors. ATMEL 89C51 microcontroller is used as control system of the elevator. The software of the elevator system is to control the overall elevator system and its algorithm. As for the hardware prototype, it is used to simulate the elevator system with three motors to control the movement and motion of the elevator in vertical and horizontal directions. Push buttons to act as input requests from passengers of the elevator from one side to other end. Limit switches are used and they are arranged at various points of mechanical structure to identify the position of the elevator.

III. DESIGN OF MICROCONTROLLER

The heart of the project work is microcontroller unit; it is designed with 89C51 ATMEL chip. These days there is no such electronic or electrical device that functions without microcontroller; we are living in the Embedded World surrounded with many embedded products designed with much variety of microcontroller chips produced by different companies. Our daily life largely depends on the proper functioning of these gadgets. Television, Radio, CD player, Washing Machine, Microwave Oven and many more house hold gadgets, and Card readers, Access Controllers, Palm devices of our work space enable us to do many of our tasks very effectively. Apart from all these, many controllers embedded in our car, which

Protection of Crowded Sport Arenas, Public Meetings and VVIP Convoys from Remotely Controlled Improvised Explosive Devices (RCIEDs)

Prof.G.Kumaraswamy Rao

ABSTRACT:

Improvised Explosive Devices (IEDs) or Remotely Controlled Improvised Explosive Devices (RCIEDs) is a homemade bomb assembled by terrorists or an anti national group or non state actors. IED/RCIED is the most dreaded weapon in the hands of terrorists and feared by the democratically elected governments across the world and by the military armed forces. It is easy to make an IED. Only Improvised material commonly available in local market is necessary. But to prevent IED from exploding, highly sophisticated technologies are required for detecting, locating and muting an IED/RCIED.

Tens of thousands of innocent civilian lives were lost across the world due to IED explosions and more than 15 times of this number were maimed. IEDs have destroyed number of military vehicles and damaged valuable infrastructure during the Middle East and Afghan wars. Statistics showed that in Iraq and Afghan war, 63% of coalition forces deaths occurred due to RCIEDs. An IED/RCIED consists of (i) An initiator (ii) Switch (activated locally or remotely) (iii) Main charge (main explosive material) (iv) Power source and (v) Container.

The tutorials deals with (i) Composition of an IED/RCIED (ii) Detection (iii) Muting (jamming). RCIED exploded in crowded places like sports arenas , public meetings etc. cause maximum casualties. Countering them requires special innovative technologies like using Remotely piloted vehicles etc. Countering IED attack is the most challenging task, which the organized military and established governments are facing today. In spite of pumping billions of dollars into research, the effective solution still remains elusive.

BIODATA

Prof.G.Kumaraswamy Rao served DRDO for more than 36 years in various capacities starting from Scientist and retired as Director & Outstanding Scientist of Defence Electronics Research Lab (DLRL) Hyderabad. Under the guidance of Dr. A.P.J. Abdul Kalam, the father of missiles, Prof. Rao designed and developed the Ground Guidance Radar System for India's first short range Surface to Air Missile Weapon System Trishul. He was the Electronics Group Head for Development of Battery Control Centre, Ground Control Centre for Akash Missile Weapon System. Prof. Rao, guided and directed the Integrated EW Programs SAMYUKTA, SANGRAHA & DIVYADRISHTI whose combined project cost was more than Rs. 2500 crores.

In recognition of the contributions as Director DLRL, he received the Best Performance Lab Award in May 2005 at Vigyan Bhawan, New Delhi. 2005 from the hands of Dr. Manmohan Singh, the then Hon'ble Prime Minister of India.

Prof. Rao passed M.E, from Osmania University in 1968 with First Rank. He studied Radar Systems course in Holland. He was one of the Board of Governors of Electronics Corporation of India. Presently he is the Senior Director at Bharat Institute of Engineering and Technology Manganpally. He published and presented more than 50 technical papers in various journals, International and national conferences. He is a member of IDST, Fellow IETE etc.

Innovative Techniques in Protective Technologies to Detect and Mute RCIEDs (Radio Controlled Improvised Explosive Devices)

Prof.G.Kumaraswamy Rao, *(Former Director DLRL Ministry of Defence)*
2 ICFAI RCIED FEB 17

Abstract— **Improvised Explosive Device (IED) also called Roadside bomb is a dreaded weapon feared by Governments, Law enforcing authorities, citizens of every country, and military forces. When an IED becomes Remotely Controlled IEDs (RCIEDs) it becomes more extremely dangerous. These devices are used by insurgents, terrorists, extremists, naxalites etc. Present RCIEDs in their various forms is posing a significant threat to civilian security, sustainable development, human rights and humanitarian operations. The pain and agony of humans when their bread winners loose their lives or limbs because of blasts is quite unfathomable. IEDs kill old, young, children, woman and armed personnel all alike. All countries of the world are suffering from the menance of RCIEDs, especially in Iraq, Afghanistan, Chechnya (Russia), USA, Libya, Srilanka, Pakistan, Indonesia, Philippines, India and many more countries. Statistics show in Iraq and Afghanistan 63% of coalition forces death occurred due to IEDs/RCIEDs. In past two years USA alone spent 12.5 billion dollars on research for countering IEDs. It is an irony that IEDs are primitive in technology, but demands high complex technologies for detecting, locating and preventing them from explosion. In the present paper the innovative technologies used for detection and preventing blasts are explained with focus on future trends in countering the RCIEDs.**

Index Terms*— *IED-Improvised Explosive Device, Detection and Muting, Remotely Controlled Improvised Explosive Device (RCIEDs) Countering RCIED.

I. HISTORY

The series of bomb blasts that rocked various locations in India and across the world, once again raked up the painful and ugly memories of bomb blasts (to citizens of Hyderabad) that took place in (i) Dillsukhnagar on 21 Feb 2013 (13 innocent civilians killed injured 84) (ii) Lumbini Park and Gokul Chat Bhandar on 25 August, 2007 (42 people died injured 54) (iii) Mecca Masjid on 18 May 2007 (9 killed and 50 injured). IED blasts across the globe have increased in recent times from 1 to around 30 per month. In last 3 years the total no. of innocent civilians killed due to IEDs has gone up to 10,850 and 29,155 were incapacitated with injuries. This number does not include the military allied troopers who died in the war against Iraq and Afghanistan. Statistics show in Iraq 63% and Afghanistan 66% coalition force's death occurred due to IED blasts. No wonder USA alone has spent 12.5 Billion dollars (75 thousand crores of Rs) on research in last two years to develop technologies to counter IEDs. Unfortunately no full proof effective technology has evolved to detect, locate and prevent the blasts from IEDs. The suicide IED blast on 21 May 1991, at Sriperumbudur in Tamilnadu, killing our Ex. Prime Minister Sri Rajiv Gandhi, totally changed the history of India. Other most dreaded IED blasts which are remembered even today are (i) 19 April 1995, at Oklahoma in USA, 169 civilians died. Ammonium Nitrate fertilizer is used in the blast (ii) 11 March 2004, 10 IED explosions rocked the city of Madrid (Spain) 191 persons died in the train attacks and more than 1800 injured. (iii) 7 July 2005, London IED attack, on transportation systems, 52 civilians died. All these incidents have shown that the perpetrators of this crime are able to strike at will and at their chosen places.

II. INTRODUCTION

IEDs are preferred by insurgents because; (i) Insurgents know that they cannot win a conventional war. They are also aware that they are fighting with a strong mighty military force which is technologically superior. Their numerical strength is far less than the opponent and they have very little financial resources. Insurgents are fighting an Asymmetric war. They resort to use of IED to destabilize the political will of the opponent. ii) Extremists, disgruntled persons who do not have faith in democratic institutions use IEDs in busy populated places to create fear and confusion in the minds of civilians. More casualities bring them more publicity from media. iii) Insurgents want to score over propaganda points to demonstrate to the world the existence and the faith in their doctrine.

Some of the advantages of IEDs are (i) They are easy to make. All components required to make an IED are available in commercial market. The container where the explosive is placed can be an item as common as a plastic pipe, pressure cooker or an emptied gas cylinder or a brief case. (ii) IEDs are cheap, light weight and technically simple to assemble. A trained illiterate can also make an IED. All one need is an explosive, a detonator, a switch (controlled by a digital watch, or remotely controlled by a Electronic Door Bell, or a sophisticated cell phone or a children's electronic toy), a battery and a container. (iii) Implanter of IED in most cases go