

2020 - 2021
13

2020 - 2021

Challenges to Industrial Internet of Things (IIoT) Adoption ☺

V. Shunmughavel

Source Title: Innovations in the Industrial Internet of Things (IIoT) and Smart Factory (/gateway/book/241806)

Copyright: © 2021

Pages: 16

ISBN13: 9781799833758 ISBN10: 1799833755 EISBN13: 9781799833772

DOI: 10.4018/978-1-7998-3375-8.ch009

Cite Chapter ▾ Favorite ★

[View Full Text HTML >](#)

(/gateway/chapter/full-text-html/269606)

[View Full Text PDF >](#)

(/gateway/chapter/full-text-pdf/269606)

Abstract

The industrial internet of things (IIoT) has made its development within a short span of time. Initially it was considered as a novel idea and currently it is a major driver in industry applications. It has created productivity and efficiency for industries worldwide. This innovative technology can become a practical reality if engineers overcome a variety of challenges. They are connectivity, cost, data integration, trust, privacy, device management, security, interoperability, collaboration, and integration. In this chapter, several facts behind the above-mentioned challenges are being explored and addressed.

Request access from your librarian to read this chapter's full text.

Full Text Preview

Background

Many detailed studies, regarding vital Challenges and open research issues regarding the implementation of Industry 4.0, have been carried out. Several challenges and fundamental issues in various circumstances that occur throughout the implementation of Industry 4.0 were addressed (Wang, et al., 2016; Vaidya, et al., 2018). They were: 1) decision-making and negotiation, 2) industrial wireless network (IWN) protocols, 3) big data and its analytic, 4) system modelling and analysis, 5) cyber security issues and 6) interoperability, 7) Investment issues. Some of the technology challenges concerning the implementation of Industry 4.0 involve the development of smart devices, the establishment of network environments, big data analysis and processing and digital production (Zhou, Liu, & Zhou, 2015). Currently the volume of data collected by industrial internet of things (IIoT) applications is very huge, making it a challenge to offer platforms with adequate capacity and performance. It is essential to make a detailed analysis of several IIoT platforms in the market and before making the decision of which one to adopt (Moura, et al., 2018).

[Continue Reading \(/gateway/chapter/full-text-html/269606\)](#)



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

Chapter 8

1b

Traffic Analysis Using IoT for Improving Secured Communication

Lakshman Narayana Vejendla, Alapati Naresh, Peda Gopi Areppalli

Internet of Things can be simply referred to as Internet of entirety which is the network of things enclosed with software, sensors, electronics, allows them to gather and transmitts the data. Because of the various and progressively malevolent assaults on PC systems and frameworks, current security apparatuses are frequently insufficient to determine the issues identified with unlawful clients, unwavering quality, and to give vigorous system security. Late research has demonstrated that in spite of the fact that system security has built up, a significant worry about an expansion in illicit interruptions is as yet happening. Addressing security on every occasion or in every place is a really important and sensitive matter for many users, businesses, governments and enterprises. In this research work we are going to propose an secre IOT architecure for routing in a network. It mainly aims to locate the malicious users in a IOT routing protocols. the proposed mechasnm is compared with the state ofd the art work and compared results shows the proposed work performs well.

Chapter 9

Challenges to Industrial Internet of Things (IIoT) Adoption

V. Shunmughavel

The Industrial Internet of Things (IIoT) has made its development within a short span of time. Initially it was considered as a novel idea and currently it is a major driver in Industry applications. It has created productivity and efficiency for industries worldwide. This innovative technology can become a practical reality, if engineers overcome a variety of challenges. They are connectivity, cost, data integration, trust, privacy, device management, security, interoperability, collaboration and integration. In this chapter, several facts behind the above mentioned challenges are being explored and addressed.

Chapter 10

Industrial Internet of Things: Benefit, Applications, and Challenges

Sam Goundar, Akashdeep Bhardwaj, Safiya Nur, Shonal Kumar, Rajneet Harish

This chapter foocused on the importance and influence of Industrial Internet of Things (IIoT) and the way industries operate around the world and the value added for society by the Internet connected technologies. Industry 4.0 & Internet of Things (IoT) enabled systems where communication between products, systems and machinery are used to improve manufacturing efficiency. Human operators' intervention and interaction is significantly reduced by connecting machines and creating intelligent networks along the entire value chain that can communicate and control each other autonomously. The difference between IoT and IIoT is that where consumer IoT often focuses on convenience for individual consumers, Industrial IoT is strongly focused on improving the efficiency, safety, and productivity of operations with a focus on return on investment. The possibilities with IIoT is unlimited, for example: smarter and more efficient factories, greener energy generation, self-regulating buildings that optimize energy consumption, smart cities that can adjust traffic patterns to respond to congestion





BANNARI AMMAN

INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University,
Approved by AICTE, Accredited by NAAC with 'A' Grade



DEPARTMENT of CSBS, CT and ISE NATIONAL CONFERENCE ON INNOVATIONS IN INFORMATION & COMMUNICATION TECHNOLOGIES-(NCIICT-2021)

Certificate of Presentation

This is to certify that Dr. /Mr. /Ms. V.Nivedhitha has participated and presented a paper in "National Conference on Innovations in Information and Communication Technologies - (NCIICT-2021)" organised by the Department of CSBS, CT and ISE held at Bannari Amman Institute of Technology - Sathyamangalam on 07- 08 May 2021.

Title of the Paper: IoT Based Coal Mining Safety For Workers Using Arduino



Co-ordinator



Dr. D. SENTHIL KUMARAN, M.E., Ph.D.,(NUS)

Principal

SSM Institute of Engineering and Technology
Kuttaipatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

Organizing Secretary



Principal





DEPARTMENT of CSBS, CT and ISE
NATIONAL CONFERENCE ON
INNOVATIONS IN INFORMATION & COMMUNICATION TECHNOLOGIES-(NCIICT-2021)

Certificate of Presentation

This is to certify that Dr. /Mr. /Ms. V.Nivedhitha has participated and presented a paper in "National Conference on Innovations in Information and Communication Technologies - (NCIICT-2021)" organised by the Department of CSBS, CT and ISE held at Bannari Amman Institute of Technology - Sathyamangalam on 07- 08 May 2021.

Title of the Paper: **CENTRALIZED WEB BASED APPLICATION FOR NON PROFIT ORGANIZATION (NPO)**



Co-ordinator

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttaiyappatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.
Organizing Secretary

Principal



BANNARI AMMAN

INSTITUTE OF TECHNOLOGY

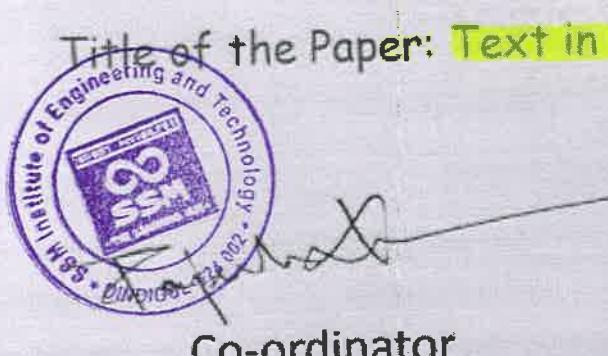
An Autonomous Institution Affiliated to Anna University,
Approved by AICTE, Accredited by NAAC with 'A' Grade



DEPARTMENT of CSBS, CT and ISE NATIONAL CONFERENCE ON INNOVATIONS IN INFORMATION & COMMUNICATION TECHNOLOGIES-(NCIICT-2021)

Certificate of Presentation

This is to certify that Dr. /Mr. /Ms. DEEPIKA S has participated and presented a paper in "National Conference on Innovations in Information and Communication Technologies - (NCIICT-2021)" organised by the Department of CSBS, CT and ISE held at Bannari Amman Institute of Technology - Sathyamangalam on 07- 08 May 2021.



Title of the Paper: Text in Your Handwriting

Co-ordinator

Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (HUS)

Principal

SSM Institute of Engineering and Technology
Kuttaiyupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.



BANNARI AMMAN

INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University,
Approved by AICTE, Accredited by NAAC with 'A' Grade

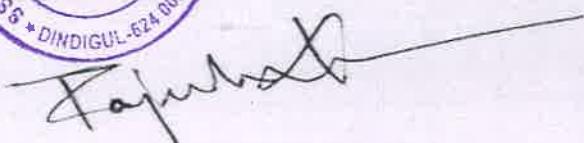


DEPARTMENT of CSBS, CT and ISE NATIONAL CONFERENCE ON INNOVATIONS IN INFORMATION & COMMUNICATION TECHNOLOGIES-(NCIICT-2021)

Certificate of Presentation

This is to certify that Dr. /Mr. /Ms. Padma Priya N has participated and presented a paper in "National Conference on Innovations in Information and Communication Technologies - (NCIICT-2021)" organised by the Department of CSBS, CT and ISE held at Bannari Amman Institute of Technology - Sathyamangalam on 07- 08 May 2021.

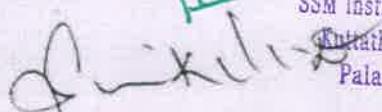



Co-ordinator

Title of the Paper: AUTOMATED STUDENT ATTENDANCE MONITORING SYSTEM USING
FACE DETECTION AND RECOGNITION-AI



Dr.D.SENTHIL KUMARAN, M.E., Ph.D.,(NUS)
Principal
SSM Institute of Engineering and Technology
Kutathupatti Village, Sindalagundu(Po),
Palani Road, Dindigul - 624 002.


Organizing Secretary


Principal



BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution; Affiliated to Anna University Chennai,
Approved by AICTE, Accredited by NBA New Delhi and NAAC with 'A' Grade)

Sathyamangalam - 638 401 Erode District Tamil Nadu



Department of CSE, ISE, CSBS and CT

Certificate of Participation

This is to certify that Dr./Mr./Mrs./Ms. Niveditha V, Asst. Prof. / CSE of

SSM Institute Of Engineering and Technology

has presented a paper titled on Smart Surveillance System For Crops From
Peacocks Using Wireless Sensor Networks and IoT

in the International Conference on Artificial Intelligence & Smart Computing (ICAISC-2020)

during 15th to 17th October 2020 at Bannari Amman Institute of Technology Sathyamangalam,



Tamil Nadu, India.

P. &
Coordinator

J. K. J. P.
Organising Secretary



Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kutthupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

Principal



Design and implementation of carry Look ahead generator in reversible logic using nano QCA

Kannaki S¹, Karthigai Lakshmi S², Jaganathan S³, Sujatha C⁴,
Bhoopesh D⁵, Balaji S⁶

¹Assistant Professor, Department of Mechatronics Engineering, Sri Krishna College of Engineering and Technology, Coimbatore, Tamilnadu, India - 641008.

^{2,4}Professor, Department of Electronics and Communication Engineering, SSM Institute of Engineering and Technology, Dindigul, Tamilnadu, India - 624002.

³Professor, Department of Electrical & Electronics Engineering, Dr.NGP Institute of Technology, Coimbatore, Tamilnadu, India – 641048.

^{5,6}UG Scholar, Department of Mechatronics Engineering, Sri Krishna College of Engineering and Technology, Coimbatore, Tamilnadu, India - 641008.

¹E-mail: kannakis@skcet.ac.in

⁵E-mail: 17eumt022@skcet.ac.in

Abstract

The idea of reversible logic is another emerging architecture that has developed its ground in research area. This argument implied zero heat dissipation at the device. According to the physical laws of quantum mechanical effect and the law of coulomb the function and heat relations are satisfied. In this paper, a carry-looking generator is built using reversible logic and its QCA have been reported. To achieve the proposed design use was made of Toffoli and BJT gate. Comparing simulation outcomes to theoretical values verifies the design. The proposed model is tested and simulated using version 2.0.3 of the QCA Designer method.

Keywords: Quantum dot Cellular Automata (QCA); Reversible logic; Toffoli and BJT gate; QCA Designer

1. Introduction

A power consumption is the most difficult field in nano scale logic design. There is a growing need for a new technology that can provide less power dissipation nano size circuits. QCA provides high density applications, low power consumption and high switching speed [1]. Because of these properties quantum gates were targeted for their enabling computational reversibility functions. The computing systems' weakness of heat dissipation is the primary driving force that draws attention to reversibility. Reversible logic preserves the knowledge that is similar to energy and momentum conservation in physics.

The reversibility inherent leads to a new frame function, which results in zero heat dissipation. In QCA reversibility is one to one mapping of output inputs. Landau indicated in 1961 that the loss of one bit of information cost would be greater than the amount of KTln2 energy joules [2]. This indicates the irreversible processes do not maintain information and are loss-making. In addition to the strength of the theoretical definition, some essential interpretation was obtained by Bennet. The bennet clock mechanism achieves less power dissipation than the KTln2 switch. Reversibility is a notion that requires bijective action. It indicates both

 Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

Dr.D.SENTHIL KUMARAN, M.E, Ph.D.,(NUS)

Principal

SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu(Po),
Palani Road, Dindigul - 624 002.



8

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul – Palani Highway, Dindigul -624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Dr. S. KARTHIGAI LAKSHMI

PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

DESIGN OF PARITY GENERATOR AND PARITY CHECKER USING QCA NONOTECHNOLOGY

in the National e-Conference on Research Trends in Communication and Information Technology held

at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu(Po),
Palani Road, Dindigul - 624 002.

(9)

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul – Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering

IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology



CERTIFICATE

This is to certify that

Dr. C. SUJATHA

ASSOCIATE PROFESSOR/ECE
of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

BLOOD VESSEL SEGMENTATION OF ANGIOGRAPHIC IMAGE

in the National e-Conference on Research Trends in Communication and Information Technology held
at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (P.O),
Palam Road, Dindigul - 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Dr. K. RAJESH

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

DETECT AND SEGMENTATION OF BRAIN TUMOR LOCULES USING IMAGE REGISTRATION BASED

NUERO FUZZY CLASSIFIER METHOD

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal

SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindagundu (Po),
Palani Road, Dindigul - 624 002.

11



SARANATHAN COLLEGE OF ENGINEERING

Approved by AICTE & Affiliated to Anna University, Chennai
Venkateswara Nagar, Panjappur, Trichy - 620 012.



Department of Electrical and Electronics Engineering
Accredited by NBA

Department of Electronics and Communication Engineering
Accredited by NBA

AICTE SPONSORED INTERNATIONAL E-CONFERENCE ON CUTTING EDGE TECHNOLOGIES IN ELECTRICAL, COMMUNICATION, EMBEDDED SYSTEM AND SOFT COMPUTING TECHNIQUES (ICECES '20)

Certificate

This is to certify that Mrs. M. JEYALAKSHMI, Assistant Professor of SSM Institute of Engineering and Technology, Dindigul for presenting a paper entitled "ENHANCED PERFORMANCE OF IMAGE STEGANOGRAPHY USING HASH CODE IN QUANTUM-DOT CELLULAR AUTOMATA" in the AICTE Sponsored International e- Conference on Cutting Edge Technologies in Electrical, Communication, Embedded System and Soft Computing Techniques (ICECES'20) held at Saranathan College of Engineering, Trichy during 05.11.2020 & 06.11.2020.

Dr. C. VENNILA
PROGRAMME COORDINATOR

Dr. M. SANTHI
CONVENER

Dr. D. VALAVAN
PRINCIPAL



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

12

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored
National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mrs. M. JEYALAKSHMI,

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

**DESIGN AND IMPLEMENTATION OF A NOVEL BINARY TO GRAY CODE CONVERTER USING QCA
NANO TECHNOLOGY**

in the National e-Conference on Research Trends in Communication and Information Technology held
at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D. (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sivathogupatti (Po),
Palani Road, Dindigul - 624 002.

13

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)



Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mrs. A. GEETHA,

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

SMART SECURITY PROTECTION OF AGRICULTURE LAND FROM ANIMALS ATTACK

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

(14)

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering

IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology



CERTIFICATE

This is to certify that

Mr. V. P. JAY FANTIN

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

EYE LESION DETECTION USING EXTREME LEARNING MACHINE

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

S. Karthigai Lakshmi

Dr. S. Karthigai Lakshmi
HoD/ECE

D. Senthil Kumaran

Dr. D. Senthil Kumaran
Principal



D. Senthil Kumaran
Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundi (Po),
Palani Road, Dindigul - 624 002.

15

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. V. P. JAY FANTIN

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

MULTIFUNCTIONAL ROBOT FOR COVID-19 SPREAD MANAGEMENT

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021,

S. Karthigai

Dr. S. Karthigai Lakshmi
HoD/ECE

D. Senthil Kumaran

Dr. D. Senthil Kumaran
Principal



D. Senthil Kumaran
Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (KUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindlagundu (Po),
Palani Road, Dindigul - 624002.

16

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul – Palani Highway, Dindigul -624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. S. DHAMODHARAN

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

**DESIGN AND IMPLEMENTATION OF AUTOMOBILE ANTENNA FOR INTER-VECHICULAR
COMMUNICATION**

in the National e-Conference on Research Trends in Communication and Information Technology held
at SSM Institute of Engineering and Technology on 9th April 2021.

S. Karthigai Lakshmi

Dr. S. Karthigai Lakshmi
HoD/ECE

D.S.K

Dr. D. Senthil Kumaran
Principal



D.S.K

Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (RUS)
Principal

SSM Institute of Engineering and Technology
Kuttaihupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

Dindigul – Palani Highway, Dindigul -624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. R. SENTHIL KUMAR

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

INTERPRETATION AND DISCLOSURE OF BREAST CANCER USING DEEP CONVOLUTIONAL NEURAL NETWORK

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

S. Karthigai Lakshmi

Dr. S. Karthigai Lakshmi
HoD/ECE

D. Senthil Kumaran

Dr. D. Senthil Kumaran
Principal



R. Senthil Kumaran
Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kattaiyampatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

18

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul -624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. R. CAROL PRAVEEN

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

UNIVERSAL ROBOT EMPLOYMENT TO MIMIC HUMAN WRITING

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D. (NUS)
Principal
SSM Institute of Engineering and Technology
Kattathupatti Village, Sindhalagundu (Po),
Palani Road, Dindigul - 624 002.

(19)

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. M. MANIKANDAN

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

DESIGN OF TRIPLE BAND MICRO STRIP SLOT ANTENNA FOR 5G APPLICATIONS

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS),
Principal
SSM Institute of Engineering and Technology
Kuttathepatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

(20)

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul – Palani Highway, Dindigul -624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering

IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology



CERTIFICATE

This is to certify that

Mr. J. VETRI MANI KUMAR

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

GSM ENABLED SMART GRID

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (P.O),
Palani Road, Dindigul - 624 002.

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering

IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology



CERTIFICATE

This is to certify that

Dr. V. JEEVANANTHAM

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

GLIOMA BRAIN TUMOUR DETECTION AND DIAGNOSIS USING HIDDEN MARKOV MODEL AND DEEP LEARNING ALGORITHM

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., [NUS]
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

(22)

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)



Department of Electronics and Communication Engineering

IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mr. S. JAYAKUMAR

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

DESIGN OF ULTRA WIDE BAND ANTENNA FOR WIRELESS BODY AREA NETWORK APPLICATION

in the National e-Conference on Research Trends in Communication and Information Technology held

at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Paianai Road, Dindigul - 624 002.

23

23



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Dr.S.KARTHIGAILAKSHMI

PROFESSOR/ECE



of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
**A SECURE AND HIGH CAPACITY DATA HIDING METHOD USING ARNOLD TRANSFORM
AND CHAOTIC SCRAMBLING** in the IETE sponsored National E-Conference on Research
Trends in Communication and Information Technology (NCRTCIT'20) held at SSM
Institute of Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr.D.SENTHIL KUMARAN, M.E., Ph.D.,(NUS)
Principal
SSM Institute of Engineering and Technology
Kuitathupatti Village, Sindalagundu(Po),
Palani Road, Dindigul - 624 002.

24



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Mr. S.DHAMODHARAN

ASSISTANT PROFESSOR/ECE

of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
DESIGN AND ANALYSIS OF MICROSTRIP PATCH ANTENNA SUITABLE FOR KU BAND
SATELLITE COMMUNICATION in the IETE sponsored National E-Conference on Research
Trends in Communication and Information Technology (NCRTCIT'20) held at SSM
Institute of Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr. D. SENTHIL KUMARAN, M.Sc., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatu Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

25



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Mr.V.P.JAY FANTIN

ASSISTANT PROFESSOR/ECE



of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
**HAND WRITTEN CHARACTER RECOGNITION USING NEURAL NETWORK AND FUZZY
LOGIC** in the IETE sponsored National E-Conference on Research Trends in
Communication and Information Technology (NCRTCIT'20) held at SSM Institute of
Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathuputhi Village, Sridhagundu (Po),
Palani Road, Dindigul - 624 002.

26



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Mr. M. MANIKANDAN

ASSISTANT PROFESSOR/ECE

of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
**DESIGN AND FABRICATION OF DOUBLE C DUAL BAND SLOTTED MICROSTRIP ANTENNA
FOR 5G TECHNOLOGY** in the IETE sponsored National E-Conference on Research Trends
in Communication and Information Technology (NCRTCIT'20) held at SSM Institute of
Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

(27)



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Mr. M. MANIKANDAN

ASSISTANT PROFESSOR/ECE



of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
DESIGN OF SLOT ANTENNA WITH DEFECTED GROUND STRUCTURE FOR WIMAX APPLICATION in the IETE sponsored National E-Conference on Research Trends in Communication and Information Technology (NCRTCIT'20) held at SSM Institute of Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupath Village, Sivagangundu (Po),
Palani Road, Dindigul - 624002.

28



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Mr. J. VETRI MANI KUMAR

ASSISTANT PROFESSOR/ECE

of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
WIRELESS POWERED COGNITIVE RADIO NETWORK TO REDUCE PATH HANDOFF in the
IETE sponsored National E-Conference on Research Trends in Communication and
Information Technology (NCRTCIT'20) held at SSM Institute of Engineering and
Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttiathupatti Village, Sivagangundu (Po),
Palani Road, Dindigul - 624 002.

29



SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Affiliated to Anna University, Chennai, Accredited by NAAC)
Dindigul – Palani Highway, Dindigul -624002

CERTIFICATE

This is to certify that

Dr.S.R.ASHOKKUMAR
ASSISTANT PROFESSOR/ECE

of **SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY** has presented a paper titled
DETECTION AND DIAGNOSIS OF SEIZURE USING SOFT COMPUTING APPROACH IN EEG SIGNAL in the IETE sponsored National E-Conference on Research Trends in Communication and Information Technology (NCRTCIT'20) held at SSM Institute of Engineering and Technology, Dindigul on 19.08.2020.

Dr. C. Sujatha
Mr. M. Manikandan
Coordinator

Mr. S. Dhamodharan
Mr. V. P. Jay Fantin
Co-Coordinator

Dr. S. Karthigai Lakshmi
Head, Department of ECE

Dr. D. Senthil Kumaran
Principal

(This is a system generated certificate, no signature is required)



26.1
Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

30

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY



Dindigul - Palani Highway, Dindigul - 624002
(ACCREDITED BY NAAC)

Department of Electronics and Communication Engineering



IETE Technical Sponsored

National e-Conference on Research Trends in Communication and Information Technology

CERTIFICATE

This is to certify that

Mrs. G. SARANYA

ASSISTANT PROFESSOR/ECE

of

SSM INSTITUTE OF ENGINEERING AND TECHNOLOGY

has presented a paper titled

AUDIO STEGANOGRAPHY BY USING CHAOS CRYPTO ENCRYPTION

in the National e-Conference on Research Trends in Communication and Information Technology held at SSM Institute of Engineering and Technology on 9th April 2021.

Dr. S. Karthigai Lakshmi
HoD/ECE

Dr. D. Senthil Kumaran
Principal



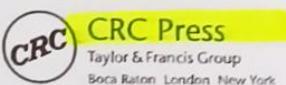
Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

Sustainable Manufacturing for Industry 4.0

An Augmented Approach

Edited by

K. Jayakrishna, Vimal K.E.K., S. Aravind Raj,
Asela K. Kulatunga, M.T.H. Sultan, and
J. Paulo Davim



CRC Press

Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an informa business




Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (WUG)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sivdhalagundu(Po),
Palani Road, Dindigul - 624 002.

First edition published 2020

by CRC Press

6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742

and by CRC Press

2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

© 2021 Taylor & Francis Group, LLC

CRC Press is an imprint of Taylor & Francis Group, LLC

Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, access www.copyright.com or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. For works that are not available on CCC please contact mpkbookpermissions@tandf.co.uk.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloguing-in-Publication Data

Names: Jayakrishna, K., 1984- editor.

Title: Sustainable manufacturing for industry 4.0 : an augmented approach / edited by K. Jayakrishna, Vimal KEK, S. Aravind Raj, K.M.A.K. Kulatunga, Mohamed Thariq Bin Haji Hameed Sultan and J. Paulo Davim.

Description: First edition. | Boca Raton : CRC Press, 2020. | Series: Manufacturing design & technology | Includes bibliographical references and index.

Identifiers: LCCN 2020015133 (print) | LCCN 2020015134 (ebook) | ISBN 9781138606845 (hbk) | ISBN 9780429466298 (ebk)

Subjects: LCSH: Manufacturing processes—Environmental aspects. | Engineering design—Environmental aspects. | Manufacturing industries—Technological innovations. | Manufacturing processes—Automation.

Classification: LCC TS155.7 .S858 2020 (print) | LCC TS155.7 (ebook) | DDC 670—dc23

LC record available at <https://lccn.loc.gov/2020015133>

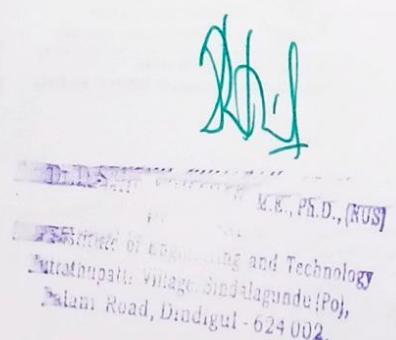
LC ebook record available at <https://lccn.loc.gov/2020015134>

ISBN: 978-1-138-60684-5 (hbk)

ISBN: 978-0-429-46629-8 (ebk)

Typeset in Times

by Deanta Global Publishing Services, Chennai, India



5.3.2.4 Composites.....	210
5.3.3 Smart Materials for Industry 4.0.....	211
5.3.4 AM for Rapid Tooling.....	211
5.3.5 Conclusions	212
References	212
Chapter 6 Ensuring Sustainability in Industry 4.0: Implementation Framework.....	215
6.1 Guidelines for Ensuring Sustainability in Industry 4.0.....	215
<i>Sivakumar K., Deepak Mathivathanan, M. Nishal, and Vimal K.E.K.</i>	
6.1.1 Introduction	215
6.1.2 Sustainability in Industry 4.0	216
6.1.3 Guidelines for Ensuring Sustainability in Industry 4.0.....	217
6.1.4 Impact of Sustainability in Industry 4.0.....	221
6.1.5 Conclusion	222
References	222
6.2 Case Studies – Sustaining Global Competitiveness with Industry 4.0.....	224
<i>R. Subhaa, R. Sudhakara Pandian, Leos Safar, and Jakub Sopko</i>	
6.2.1 Introduction	224
6.2.2 Challenges and Issues of Industry 4.0.....	224
6.2.3 Technologies of Industry 4.0	225
6.2.3.1 Internet of Things (I.o.T.).....	225
6.2.3.2 Cyber-Physical Systems (C.P.S.).....	225
6.2.3.3 Cloud Manufacturing.....	226
6.2.3.4 Big Data Analytics.....	226
6.2.4 Case Studies Based on Industry 4.0 Technologies.....	226
6.2.4.1 Cases on Neural Network Technologies	226
6.2.4.2 Case Studies on I.o.T. Technologies.....	226
6.2.4.3 Cases on Big Data Technologies.....	227
6.2.4.4 Cases on Industrial Wireless Network (I.W.N.) Technologies.....	228
6.2.4.5 Industrial Internet of Things (I.I.o.T.) Technologies	229
6.2.4.6 Logistics Optimisation Technologies	230
6.2.5 Summary and Final Remarks	231
References	231
6.3 Modelling the Interrelationship of Factors Enabling Agile-Industry 4.0: A DEMATEL Approach.....	232
<i>Srijit Krishnan, Sumit Gupta, and K. Mathiyazhagan</i>	
6.3.1 Introduction	232

Dr.D.SENTHIL KUMARAN, M.E., Ph.D.,(NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindhalagundu(Po),
Palani Road, Dindigul - 624 002.





CHENNAI INSTITUTE OF TECHNOLOGY

Sarathy Nagar, Kundrathur, Chennai - 600069.

321

16

KNOWLEDGE 4.0 - TECHNICAL WEBINAR SERIES



KNOWLEDGE 4.0

Technical Webinar Series

Certificate

This is to certify that

Dr. R. Subhaa

of **SSM Institute Of Engineering And Technology**

has participated in the **International Conference on Computing, Communication and Information Technology** and presented a paper entitled

An Internet-of-Things Enabled Smart Fire Fighting System

organised by Departments of Computer Science and Engineering and Information Technology, Chennai Institute of

Technology on 30th & 31st July, 2020.



Dr. D. SENTHIL KUMARAN, M.E., Ph.D. (HOS)
Principal
SSM Institute of Engineering and Technology
Kottathupatti Villa, Srinivaspuram (P.O),
Palani Road, Dindigul - 624002
[Signature]

Principal

33

CHENNAI INSTITUTE OF TECHNOLOGY

Sarathy Nagar, Kundrathur, Chennai - 600069.

International Conference on Computing, Communication and Information Technology



Certificate

This is to certify that
Dr. R. Subhaa

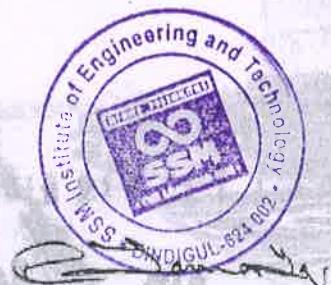
of _____ SSM Institute Of Engineering And Technology

has participated in the International Conference on
Computing, Communication and Information Technology
and presented a paper entitled

Cyber Physical System Architecture in the Perspective of Industry 4.0

organised by Departments of Computer Science and
Engineering and Information Technology, Chennai Institute of

Technology on 30th & 31st July, 2020.



Organizing Secretary



Dr.D.SENTHIL KUMARAN, M.E., Ph.D., (W.B.U)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sivagangai (P.O),
Palani Road, Dindigul - 624002

Principal



UOB-IEASMA-126: Design of HVAC System for Electrical Room, Saudi Arabia

Nithin K JOSEPH

SSM Institute of Engineering and Technology, Tamilnadu,
India, nithinkjoseph007@gmail.com

E. ELBAKUSH

Higher Education Consultant, Fredericton, Canada, e.elbakush@unb.ca

M. MUTHUKANNAN

SSM Institute of Engineering and Technology, Tamilnadu, India, mmk.mech59@gmail.com
P Shankar KANNAN

SSM Institute of Engineering and Technology, Tamilnadu, India, sankar7862@gmail.com
Dinesh KUMAR V

Kalasalingam Academy of Research and Education, Tamil Nadu, India,
dineshkumar@klu.ac.in

Abstract

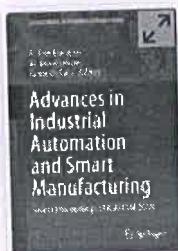
Today the air conditioning design field is more technically complicated than ever before. While design innovations and product improvements promise sleeker, more versatile, more powerful and more energy efficient air conditioners, the challenge today lies in identifying the most appropriate Energy Efficient product, or by products, for the usages at the other hand. Indeed, today the emphasize is no more on understanding air conditioning "products but on creating solutions and not just solutions but customized Energy Efficient solutions that suit specific cooling needs of specific establishments and business. The consultant or designer who understands the dynamic of the client business is more likely to offer better long-term solutions than one who does not. No one contradicts on the fact that man work effectively in conductive environments. The emergence of HVAC field made it possible to maintain himself in comfort zone with the thermal environment irrespective of seasonal variations within his surroundings. It is the cost and degree of comfort that determine to what extend the function of air conditioning is needed. Every air conditioning application has its own special needs and provides its own challenges College Building Airports, Hotels shopping mall Office completes and Banks need uniform comfort cooling in every corner of their sprawling spaces and activities involving computer Electronics, secret products precession manufacturing communication network and operation in hospitals, in fact many areas of programming would come to a halt, so air conditioning is no longer luxury but an essential part of modern living. To provide human comfort while working it is very essential to maintain steady temperature at the working places.

Keywords: HVAC, Electrical Energy, Numerical Investigation, Heat load Calculation

Introduction

The HVAC systems are playing delight role in and around the world, Heating Ventilation Air Conditioning Systems





Advances in Industrial Automation and Smart Manufacturing, pp 725–732

[Home](#) > [Advances in Industrial Automation and Smart Manufacturing](#) > Conference paper

Parametric Effect and Laser Beam Machining of Rhenium Diboride-Based Molybdenum Metal Matrix

Anbarasu Augustine, Joseph Dominic Vijayakumar, S. Paulsingarayar, S. Marichamy, B. Stalin & V. Dhinakaran

Conference paper | First Online: 21 October 2020

1182 Accesses

Part of the [Lecture Notes in Mechanical Engineering](#) book series (LNME)

Abstract

The applications of super hard material have been increased in aerospace, marine and automobile industries. In the present, the investigation deals with rhenium diboride (ReB_2)-based molybdenum metal matrix which is fabricated through stir casting method. Rhenium diboride is mixed to the molybdenum with various weight percentages such

Dr. D. SENTHIL KUMARAN, M.E., Ph.D., (NUS)
Principal
SSM Institute of Engineering and Technology
Kuttathupatti Village, Sindalagundu (Po),
Palani Road, Dindigul - 624 002.

