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CENTRE FOR SMART ENGINEERING APPLICATIONS
(2020-23)

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Smart Engineering Applications Research Centre

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Centurion University of Technology & Management, Odisha, India

CEO: Dr. Harish Chandra Mohanta

RC Coordinator: Dr. Chandra Sekhar Dash

Associate RC Coordinator: Mrs. Swarna Prabha Jena

Mentor: Mr. Babu Shankar, MD, GT Tech.

Do what you think is interesting, do something that you think is fun and worthwhile, because otherwise you won't do it well anyway.

—Brian W. Kernighan

Message from CEO

I am delighted to see the preparations for the publication of the R&D Profile of the Research Centre, highlighting the research strength and contributions made including a brief on projects being run. It is an important document for not only the Institute but also for the industry and research laboratories to learn about the research capabilities of the Institute so that they can avail of the research services of the Institute, effectively. It would also benefit prospective employers to be aware of the training our students have received. Furthermore, it would help disseminate the R&D-related achievements of the Institute among the academia of the country and abroad for appraisal and it may lead to possible collaborative research. I am confident that it would enable the potential future faculty to comprehend the Institute's R&D standing as it strives to establish itself on the global academic excellence map. This would also serve to highlight the accomplishments of the contributing faculty members and could encourage the promotion of cutting-edge, innovative, and socially significant research. I congratulate the RC coordinator and his team for bringing out this document and look forward to having its updated versions in the future.

Prof. Harish Chandra Mohanta
CEO
Smart Engineering Applications Research Centre

Team Members: Smart Engineering Applications

Dr. Harish Chandra Mohanta
CEO, Smart Engineering Application

Dr. Chandra Sekhar Dash
RC Coordinator

Prof. Swarna Prabha Jena
RC Co-Coordinator

Dr. Chinmayee Dora
Assistant Professor

Prof. Subrat Kumar Pradhan
Assistant Professor

Prof. Sandipan Pine
Associate Professor

Dr. PS Rao
Professor

Dr. Santosh Patro
Assistant Professor

Dr. S V S K Deepak Kumar
Assistant Professor

Ms. Sarmistha Sahu
Assistant Professor

Mr. Arun Kumar Sahoo
Assistant Professor

Dr. Srikant Sahu
Assistant Professor

Prof. Satyanarayan Padhy
Assistant Professor

Dr. Pendurthy
Anthony Sunny Dayal
Associate Professor

Dr. Joginaidu Kuriti
Assistant Professor

Dr. Sudhansu Samal
Associate Professor

Dr. Amit Kumar Sahoo
Assistant Professor

Mrs. Smitanjali Rout
Research Scholar

Prof. K Madhava Rao
Associate Professor

Prof. J Lalu Prasad
Assistant Professor

Dr. Konga Upender
Assistant Professor

Dr. Vinayak Majhi
Assistant Professor

Contents

1 Introduction

The Centre for Smart Engineering Applications was established in the year 2020 with an aim to develop low-cost, indigenous technologies through Research & Development (R& D).

1.1 Aim and objective of the RC

The main objectives of the Research Centre are:

- To be a renowned knowledge generator and repository for innovative technological and inclusive solutions in the areas of Engineering and Technology.
- To develop cooperation at national and international levels with universities, leading scientists, and Industries.
- To promote the introduction of innovative and entrepreneurial thinking.
- Enhancing the career opportunities for students through industry-institute interaction, and value-added projects in cutting- edge of technology.
- Supporting the Research & Development activities as a consultancy for industrial projects.
- Publication of research results in National and international peer-reviewed journals and filing patents.

1.2 Focus Area

- Digital Manufacturing Solutions for Garments and Mining Industries
- Development of indigenous Low-cost Insulin Pump.

- Robotics
  - i Development of pick and place robot for planting machinery
  - ii Mobile Robot
  - iii Bravo Robot
- Automatic multi-crop weeder & Design and Testing of Solar operated Seed drill
- Synthesis and Physical Design of Chromite M SOC
- Development of indigenous ECU and VCU for three and four-wheelers respectively.

1.3 Software Tools

We have access to the State of Art simulation tools such as MATLAB, Cadence EDA Tool, Xilinx Vivado, Verilator, Bluespec compiler, HFSS, Ansys, Keilμ Vision, Multisim, and Eagle.

1.4 Student Involvement

The Centre encourages and involves Undergraduate & Postgraduate students and Research scholars besides faculty members to carry out the research activities.

1.4.1 Expected Outcomes

1. We are developing a low-cost indigenous Insulin pump that could serve the purpose of Insulin Therapy to diabetes patients.
2. The digital manufacturing solution for product tracking in Garments and Mining Industries.
3. An electronic control unit (ECU), for three-wheeler vehicles.
4. Chromite-M-SOC chip solutions

5. The Centre encourages and involves Undergraduate & Postgraduate students and Research scholars besides faculty members to carry out the research activities. The involvement of students in research centre activities aids in inculcating an entrepreneurial mindset to make them job creators. Besides it aids in process of publication of Journals and Patents.

1.4.2 Activities being carried out

1. We organize professional development workshops and FDP/SDP on problems identified by the research work conducted at the centre for the training of faculty academic staff and students to share research findings with them.

2. Organization of Industry talks to educate the members about simulation tools.

3. Product development

4. Offering Domain/Skill, Certification Courses, and Internships.

2 Research and Projects

2.1 Projects

2.1.1 Insulin Pump prototype

An insulin pump delivers a pre-programmed amount of insulin to a diabetic patient in a continuous manner. Such continuous insulin therapy is known to offer significant advantages in better blood glucose regulation over multiple daily insulin shots, in addition to being less painful and operationally convenient. However, taking daily insulin shots is a common practice among many diabetic patients. This is primarily because insulin pumps available in the market are highly expensive and hence non-affordable for a large segment of global patients in general and Indian patients in particular. In view of this, the main aim of this project is to design and develop a functional insulin pump prototype with significant cost reduction. Despite being cost-effective, however, it will retain all advantages of commercially available insulin pumps, such as:

i Accuracy of insulin delivery,

ii Light weight and compactness

iii Safety and reliability

iv Convenience of usage etc.

To cut down the overall development time cycle, the design will be made compatible to commercially available bio-compatible components of the pump, namely the reservoir, infusion set and cannula, which also happen to be non-expensive. On the other hand, several key components of the pump, such as the gear drive, printed circuit board, display system, casing etc. will be indigenously designed and developed, which will be responsible to bring down the cost significantly. The control system logic responsible for operation of various hardware components will also be developed

and implemented inhouse. Note that the pump will also have blue-tooth communication capability and enough memory so that (i) it can be driven by an external app from a smart phone and/or (ii) an artificial pancreas system logic and be embedded into it.

- Braking system design -functional
- Dynamic behavior of insulin pump system
- Drop impact test
- Infusion set pipe kink test
- CFD analysis in the cartridge
- MBD analysis of lead screw arrangement
- S-N analysis for lead screw
- Power Analysis Done
- Motor and LCD interfacing with Raspberry PI

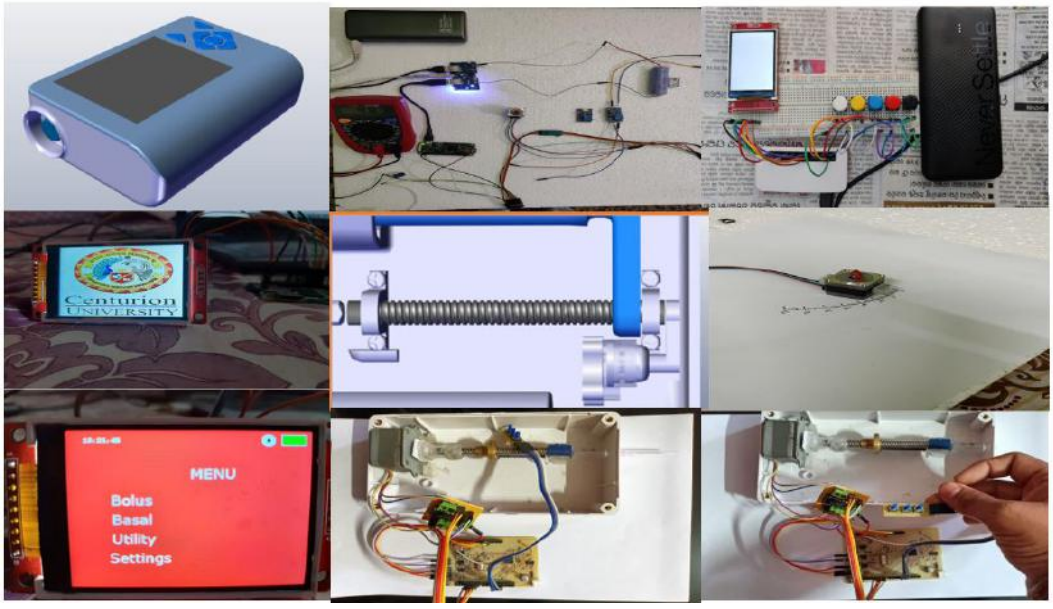


Figure 2.1: Insulin Pump Prototype

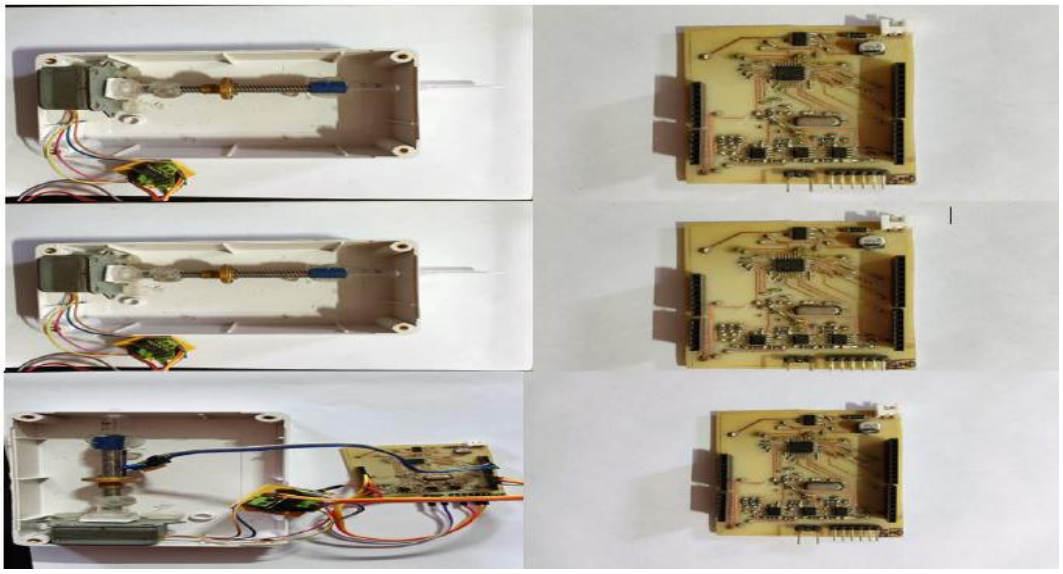


Figure 2.2: Insulin Pump Prototype in Making

2.1.2 Electronic Control Units

1. Power train design for existing E-Rickshaw
   a) This Electric Powertrain design is based on 48 Volt, 50Amp, and 1KW BLDC Motor.
   b) The base ECU is tested with Arduino Mega, Teensy 3.2, and Teensy LC.
   c) The PCB Design for the Board is completed.
   d) No-Load and Load Test with the controller was done.
   e) In No-load and existing differential, we got the speed up to 3000 RPM.
   f) In load we tested with Teensy 3.2 (32 Bit) Controller but due to heat we got some damage, and a newly designed board is completed, and testing will have done by one or two days.
   g) Next target is to design the power train for 2 Ton loader.
   h) Communication with CAN protocol also require for sensors.
2. AUTOSAR Designing
   a) Started learning for AUTOSAR using MATLAB.

3. Battery Management System
    a) Design of 48Volt, 10Ah BMS Design with Li-Ion battery
        i. Testing for 48 Volt, 100Ah will be the next target after completion of 10Ah.

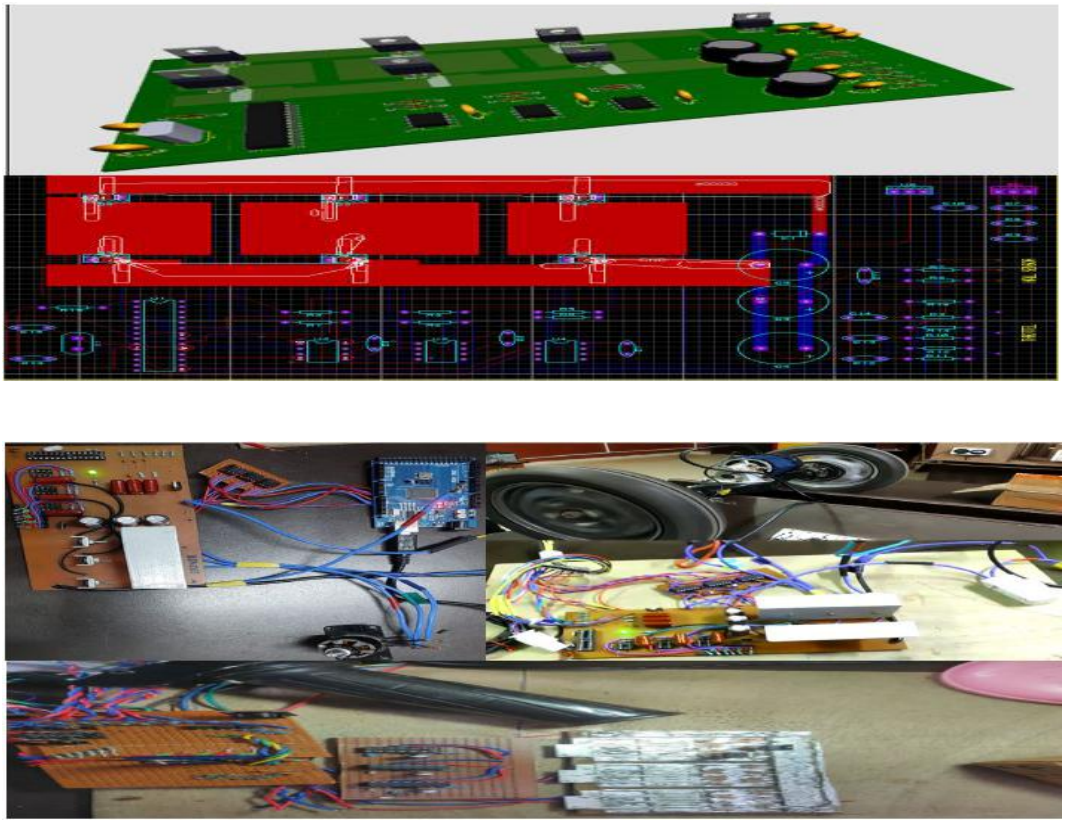


Figure 2.3: PCB design for 48volt 50Amp, 1KW BLDC motor Driver

4. Design and Development of Electric Scooter
   Electric scooters are defined as motorized bicycles propelled by an Electric motor and controlled by a controller using battery power. It is easy to ride and lets you breeze up and down hills without even breaking a drop of sweat. Electric scooters are impressively energy efficient, and they are non-polluting. It doesn't contribute to sound pollution. Motorized kick scooters are used in law enforcement, security patrolling, and leisure. They are popular in urban areas and are used as an alternative to bicycling or walking.

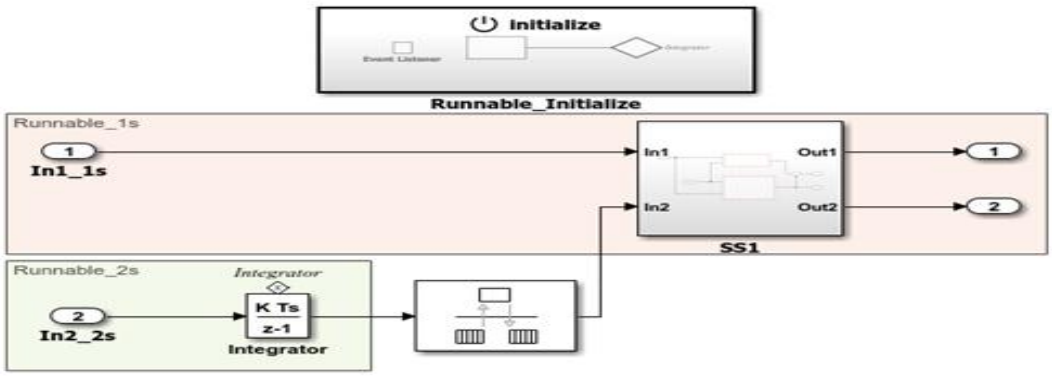


Figure 2.4: Fundamental Block study of AUTOSAR implementation

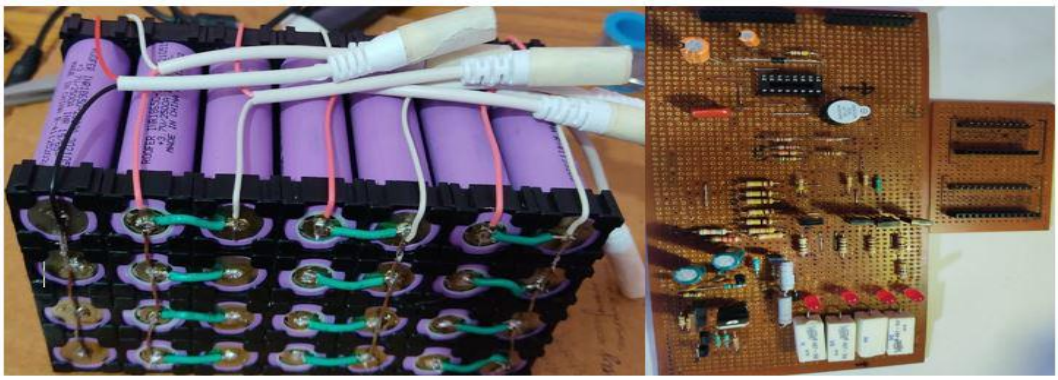


Figure 2.5: Battery Pack for 48volt 10Ah Lithium-Ion Battery

2.1.3 Design and Development of Mobile Robot for multi-purpose applications using Computer Vision

Robotics is the intersection of science, engineering, and technology that produces machines, called robots, that substitute for (or replicate) human actions. Mobile robots function using a combination of artificial intelligence (AI) and physical robotic elements, such as wheels, tracks, and legs. Mobile robots are becoming increasingly popular across different business sectors. They are used to assist with work processes and even accomplish tasks that are impossible or dangerous for human workers. These mobile robots can be used in various applications like the medical field for automatic sanitizing and distribution of medicines, and in agriculture for various applications starting from ploughing, sowing, and automatic spread of fertilizer etc. It can also be used for security applications as well as for

Figure 2.6: Development of Mobile Robot

tracking and monitoring applications. A design of a robot that can perform all these versatile actions needs strong intelligence and controls embedded in its core and hence, AI/ML-based algorithms that can perform these complex operations. Computer vision-based algorithms will also be a part of the design to perform the task.

2.1.4 Design Specification

- ROBOT DIMENSIONS: 57X54X37.5 cm (LXBXH)
- PAYLOAD: 100kg
- BATTERY: 24V
- MOTOR TORQUE:32 kg-cm
- MOTOR SPEED:200rpm
- GROUND CLEARANCE: 8cm
- WHEEL RADIUS: 10cm
- BODY: MILD STEEL

Figure 2.7: Electric Scooter

- 4 WHEEL DIFFERENTIAL DRIVE SKID STEER

Wheel Differential Drive Mobile Robo

2.1.5 E-Rickshaw Prototype

2.1.6 Real Time Garment Production- Line Tracking System

In the manufacturing industry, the production line method is proven as the most effective process. Thus, the processing time has to be ideally planned and executed to achieve the maximum possible efficiency. This study describes the process of monitoring the stitching process of a standard full-sleeve shirt using the latest technology with a cost-effective approach. Modern technologies like IIoT, RFID, MQTT, and Wi-Fi are employed. Here we have concentrated on a study to track the time consumed by each job per operation for a full-sleeve shirt. In this process of study the working of the technology, architecture of the concept, and various devices used were studied in deep and analyzed so as to make this study a cost-effective and efficient way of upgrading the existing industries to the next level i.e. Industry 4.0.

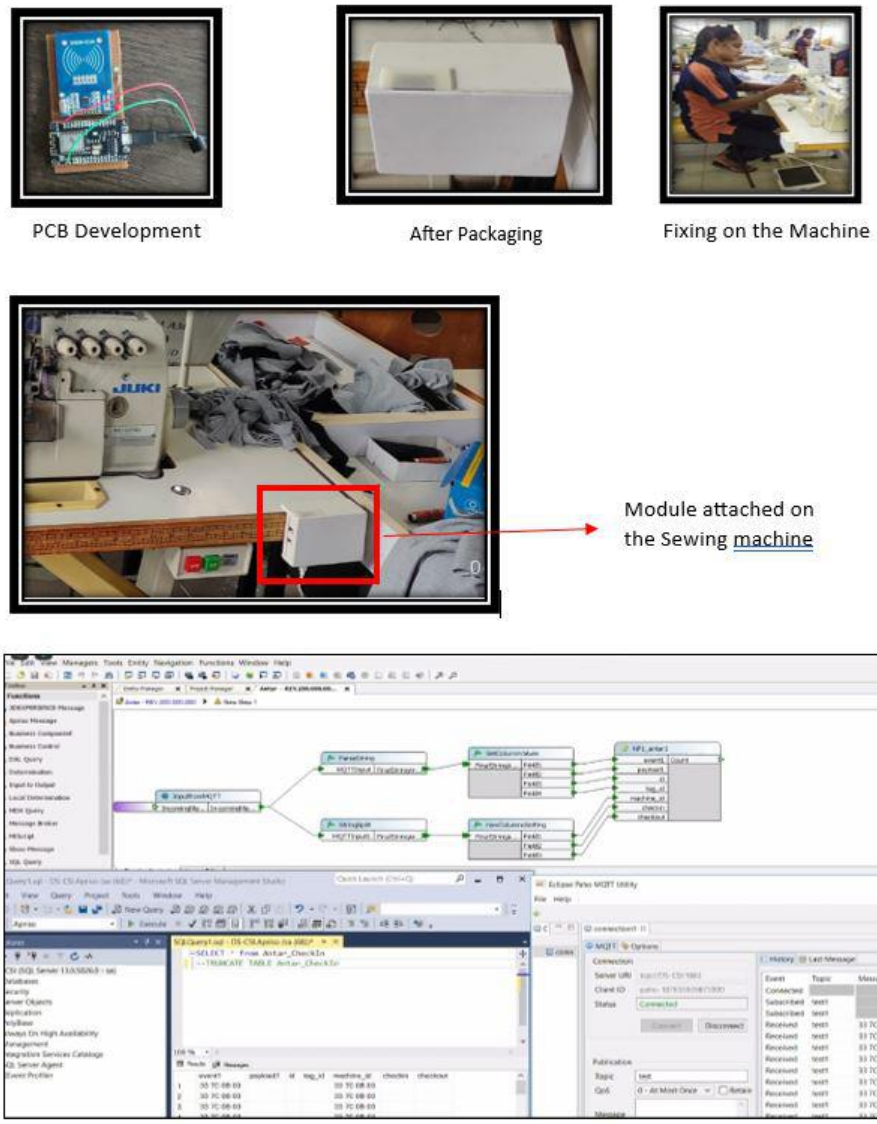


Figure 2.8: Real Time Garment Production- Line Tracking System

Today is the age of SMART; including Industries. So smart industries are the industries of today capable of maintaining connectivity and live monitoring by exploiting the cloud and the internet. This is a breakthrough for industries in order to analyze and optimize on the go. Many industries have come up with such kind of techniques and prototypes giving rise to a revolution in the industries and finally, Industry 4.0 was born, the age of the “Smart Industry”. The IIoT encouraged industries to go smart thereby

resulting in an increase in business opportunities through a reduction in time to market. The new industries easily coped up with the modern age of connectivity and information sharing but the older industries lagged behind due to the huge cost of upgradation and automation that resulted in untimely closures. This study can be a breakthrough for those industries to cope-up the market progress side by side.

IIoT has made is possible to make the industry smarter by providing aid in Factory Planning, Capacity Expansion, Capacity Validation, Process Optimisation, Improved Resource utilization, Improved Manufacturing Planning, Manufacturing Time and cost reduction and Work Process Simulation. All these advantages that IIoT has posed the industry make the industry digital and hence can be termed as Digital Manufacturing. Industry 4.0 features the following to satisfy modern needs: Smart, Connected, Flexible production, High-Quality Services, Faster to Market, IT Optimised, Safer working Environment, Lower Production Cost, and Automation through Cyber Physical collaboration. Tracking the process of garment production is an important part of the apparel industry and mostly it is based on Touch Switch, Barcode and RFID systems. These systems have their own advantages and disadvantages: The touch switch system is a physical system that needs to be touched every job that starts and ends its process. It's a very cost-effective means of tracking the process in a production-based factory but it is not capable of setting up a unique identification number for each job so though it can consider the time interval calculation to be accurate and dependable, it is not reliable to calculate the throughput or efficiency. Barcode system is a reliable system with a very low cost of running in the long run but the initial cost of installation is high it has a drawback of being used manually in the majority of the cases and also it has a drawback of strict line of sight. The RFID technology is capable of obtaining a unique id for each job as well as automation is possible. The initial cost of installation is high but a piece of detailed information on the operations can be obtained that can be used for deeper analysis and actions. This is the technology that is employed in this study.

2.1.7 Physical Design of Chromite *M SoC*

The Chromite M SoC is amongst InCore's first No-Cost Eval SoC on FPGA based on the Chromite core generator. This SoC is targetted for IoT and Industrial class applications requiring a 64-bit micro controller. The com-

ponents of the Chromite M SoC are compliant with available RISC-V standards.

a Hardening : Take the chromite core through the gpdk 45nm and perform hardening exercise

b DFT : adding DFT support for chromite pipeline

c To write TCL scripts in order to automate the process of RTL synthesis (Front End Design) and Physical design (RTL-GDS-II) (Back-end Design).

Methodology

Phase I: FPGA Implementation in ARTY 100T board Phase II: Synthesis and Physical Design

- **Genus (for synthesis)**
- **Incisive for GLS (gate level simulations)**
- **Innovus RTL to GDSII Tool**

Chromite *M SoC Architecture*

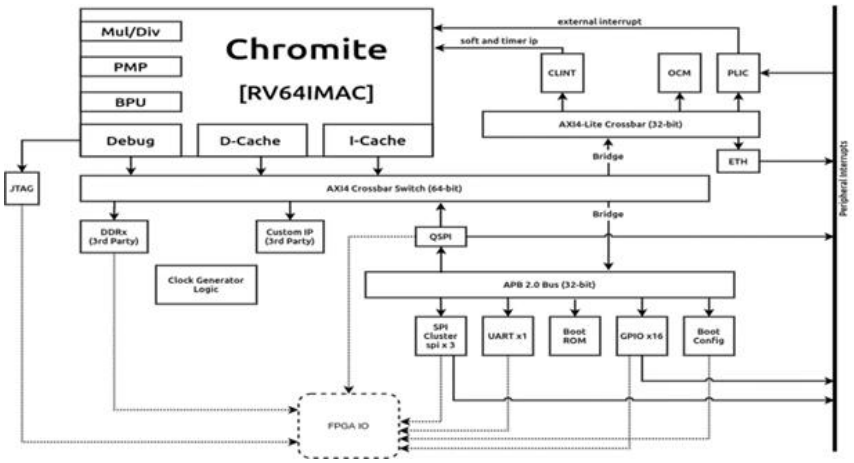


Figure 2.9: Chromite M SoC Architecure

RTL SYNTHESIS OF Chromite *M SoC*

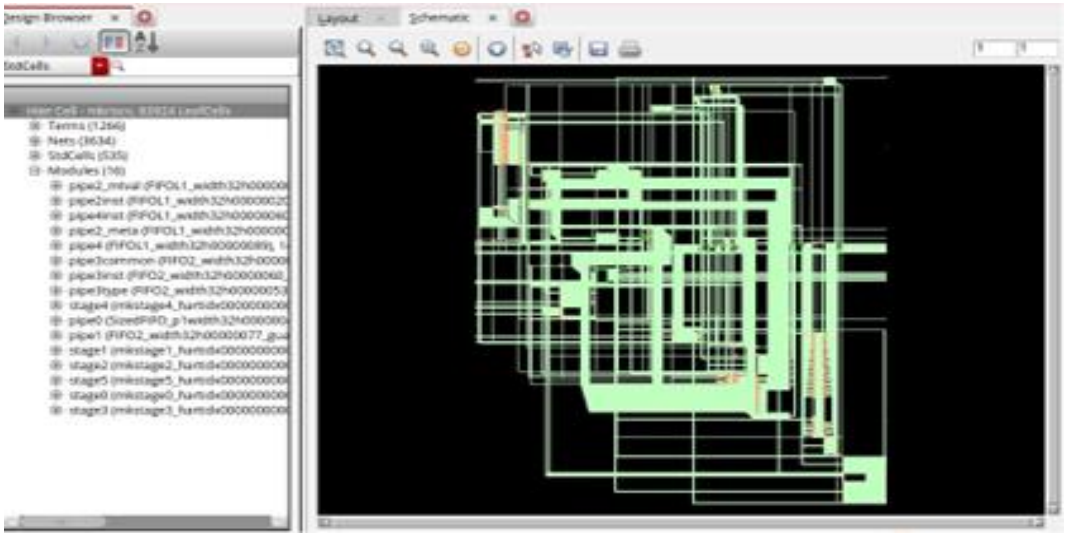
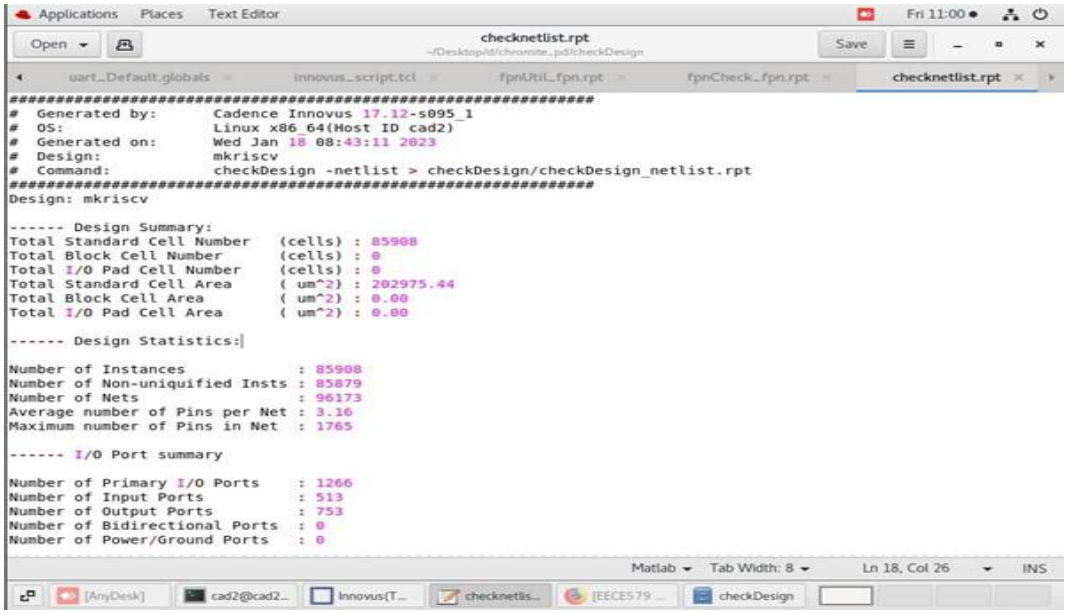


Figure 2.10: RTL SYNTHESIS OF Chromite M SoC

Report Analysis OF Chromite *M SoC*



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Applications  Places  Text Editor                                   Fri 11:00
Open   checknetlist.rpt                                  Save
uart_Default.globals  innovus_script.tcl  fpnUtil_fpn.rpt  fpnCheck_fpn.rpt  checknetlist.rpt
#####################################################################
#  Generated by:       Cadence Innovus 17.12-s095_1
#  OS:                 Linux x86_64(Host ID cad2)
#  Generated on:       Wed Jan 18 08:43:11 2023
#  Design:             mkriscv
#  Command:            checkDesign -netlist > checkDesign/checkDesign_netlist.rpt
#####################################################################
Design: mkriscv

------ Design Summary:
Total Standard Cell Number   (cells) : 85908
Total Block Cell Number      (cells) : 0
Total I/O Pad Cell Number    (cells) : 0
Total Standard Cell Area     ( um^2) : 202975.44
Total Block Cell Area        ( um^2) : 0.00
Total I/O Pad Cell Area      ( um^2) : 0.00

------ Design Statistics:

Number of Instances             : 85908
Number of Non-uniquified Insts : 85879
Number of Nets                  : 96173
Average number of Pins per Net : 3.16
Maximum number of Pins in Net  : 1765

------ I/O Port summary

Number of Primary I/O Ports    : 1266
Number of Input Ports          : 513
Number of Output Ports         : 753
Number of Bidirectional Ports  : 0
Number of Power/Ground Ports   : 0
Matlab  Tab Width: 8  Ln 18, Col 26  INS
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Figure 2.11: Report Analysis OF Chromite M SoC

Chromite M SoC Layout

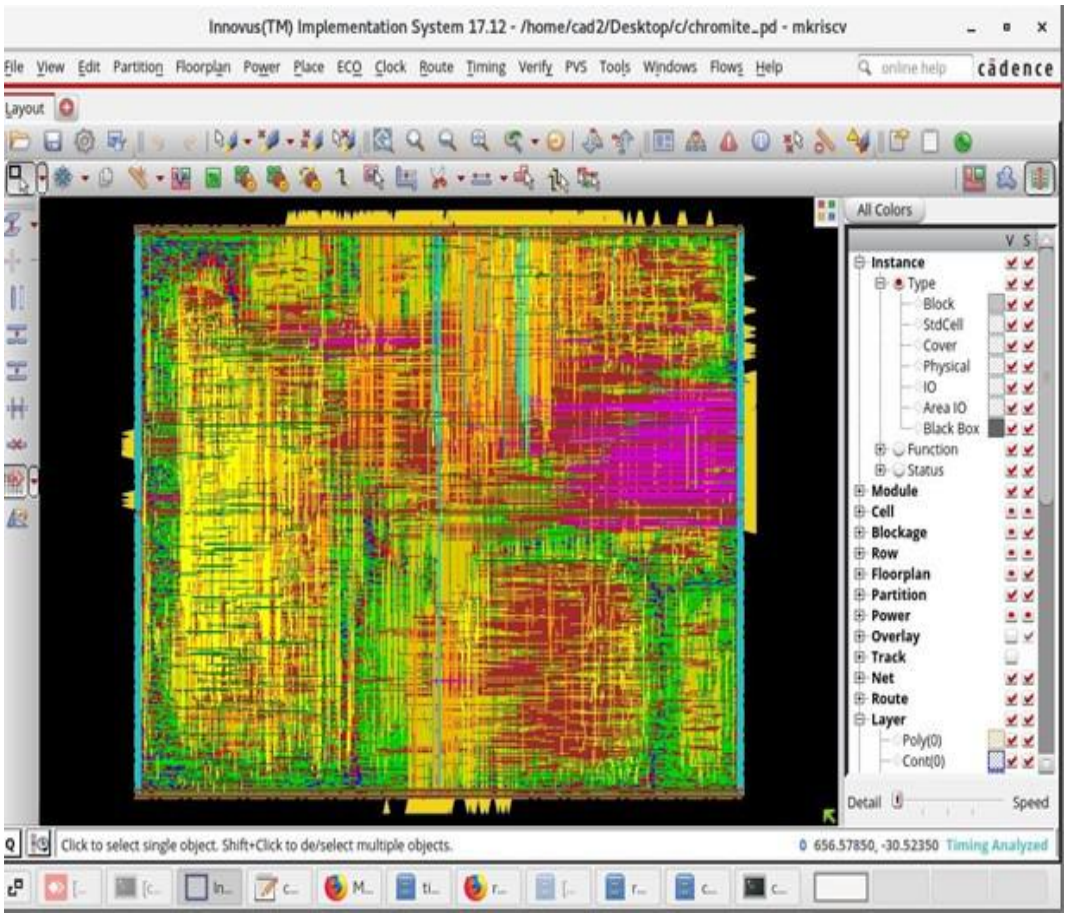

Figure 2.12: Chromite M SoC Layout

3 Publications, Patents, Internships and Workshops

3.1 Journals

1. **Rajesh Kumar Misra, "Design & Performance comparison of 8*8 Multiplier circuit using Modified Gate Diffusion Input Adder cell", Indian Journal of Natural Sciences, Vol 10, Issue 60, June 2020**

2. **Jeebaratnam, "FPGA design for implementation of the 2 D discrete cosine transformation for image processing", Test Engineering and Management (TEM), Vol 83, Issue March-April, pp 17220-17224, June 2020**

3. **Sandipan Pine, "PLL Circuit using 45nm Technology for Wireless Domain", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20234-20237, June 2020**

4. **Sandipan Pine, "Design of SRAM Cell in 45nm Technology and Optimization for Power", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20252-20255, June 2020.**

5. **Sandipan Pine, Sagar Maitra, "Smart Irrigation for Food Security and Agricultural Sustainability", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20435-20439, June 2020**

6. **Sagar Maitra, Tanmoy Shankar, Masina Sairam and Sandipan Pine, "Evaluation of Gerbera (Gerbera jamesonii L.) Cultivars for Growth, Yield and Flower Quality under Protected Cultivation", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20271-20276, June 2020**

7. **Sagar Maitra, Sandipan Pine, Tanmoy Shankar and Biswajit Pramanick, "Nutrient Management in Foxtail millet: A Review", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20271-20276, June 2020**

8. **Jeebaratnam, "Cattle Activity and Health Monitoring System Using Accelerometer Sensor", Test Engineering and Management (TEM), Vol 83, Issue May-June, pp 14027 - 14031, June 2020**

9. **Satyanarayan Padhy, Chandra Sekhar Dash, "Design and Implementation of Pipeline Architecture in Cadence Platform", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 20277-20280, June 2020**

10. **Satyanarayan Padhy, Chandra Sekhar Dash, "ASIC Implementation of Halftone Image Converter", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23340-23343, June 2020**

11. **Satyanarayan Padhy, Chandra Sekhar Dash, Deepak Barik, "Design of SRAM Augmented 32 Bit Synchronous FIFO", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23336-23339, June 2020**

12. **Satyanarayan Padhy, Chandra Sekhar Dash, "Design and Implementation of Memristor based Sequential Circuits", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23357-23359, June 2020**

13. **Chandra Sekhar Dash, Satyanarayan Padhy, "Design and Implementation of Approximate Adder Using Cadence", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23344-23347, June 2020**

14. **Chandra Sekhar Dash, Satyanarayan Padhy, "Design and Implementation of UART Protocol", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23352-23356, June 2020**

15. **Chandra Sekhar Dash, Satyanarayan Padhy, "Design and Implementation of Wallace Tree Multiplier", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23348-23351, June 2020**

16. **Chandra Sekhar Dash, Satyanarayan Padhy, Deepak Barik, "Design and Implementation of Dual-Port SRAM", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp 23332-23335, June 2020**

17. **Rajesh Kumar Misra, Prafulla Kumar Panda, Anjan Sahoo, "Rainfall Prediction using Machine Learning Approach: A Case Study for the State of Odisha", Indian Journal of Natural Sciences, Vol 4, Issue 60, pp 20124-20133, June 2020.**

18. **Binod Kumar Padhi, Kanhu Charan Bhuyan, Satyanarayan Padhy, "Design, Analysis and Controller design of ZETA Converter", Test Engineering and Management (TEM), Vol 83, IssueMay-June, pp 14167 - 14175, May 2020**

19. **Satyanarayan Padhy, Chandra Sekhar Dash, "ASIC Implementation of Limited Instruction RISC Processor", Journal of Xidian University, Vol 14, Issue 5, pp 5998-6003, May 2020**

20. **Chandra Sekhar Dash, Satyanarayan Padhy, Nimay Giri, "ASIC Implementation of CMOS Vedic Multiplier", Journal of Xidian University, Vol 14, Issue 5, pp 5291-5295, May 2020**

21. **Swarna Prabha Jena, Subrat Kumar Pradhan, "Smart Shopping Basket: An application of Radio Frequency Identification Technique", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp-23412-23417, June 2020.**

22. **Swarna Prabha Jena, Subrat Kumar Pradhan, "Multi-Level Security & Control System of Vehicle using Smart Technologies", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp- 23406-23411, June 2020.**

23. **Swarna Prabha Jena, Subrat Kumar Pradhan, "Wireless Temperature –Humidity Monitoring Controlling and Analysis of Multiple Room", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp-23418-23423, June 2020.**

24. **Swarna Prabha Jena, Subrat Kumar Pradhan, "Voiced Based Electronics Guidance System for Visually Impaired Pedestrians", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp- 23424-23431, June 2020.**

25. **Swarna Prabha Jena, Subrat Kumar Pradhan, "Self-Driven Metro and Biometric Reservation System Using ARM Microcontroller", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp- 23432-23438, June 2020.**

26. **Subrat Kumar Pradhan, Swarna Prabha Jena, Debaraj Rana, "Real-Time Slide Door Automation & Security System with RF Tech-**

nology", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp-23307-23313, June 2020.

27. **Subrat Kumar Pradhan, Swarna Prabha Jena, Debaraj Rana, "LPG Leakage Detection and Automated Booking System Using LPC2129", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp- 23314-23318, June 2020.**

28. **Priyanka Biswal, Debasnan Singh, Puja Nayak, Subrat Kumar Pradhan, Swarna Prabha Jena, "Remote Monitoring Controlling & Automation of Protected Environment Cultivation", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp- 23319-23326, June 2020.**

29. **Arun Kumar Nayak, Subrat Kumar Pradhan, Swarna Prabha Jena, "ARM 7-Based Alcohol Detection and Accident Prevention of Vehicle", Indian Journal of Natural Sciences, Vol 10, Issue 60, pp-23327-23331, June 2020.**

30. **Debaraj Rana, Himanshu Sekahar Sethi, Swarna Prabha Jena, Subrat Kumar Pradhan, "Classroom Attendance System with IoT Notification", Test Engineering and Management (TEM), Mattingly Publishing Co, vol-83, pp-17051-17057, APR 2020.**

31. **Swarna Prabha Jena, Subrat Kumar Pradhan, Debaraj Rana, "Implementation of Hand Gesture System for Speech Impaired People", Test Engineering and Management (TEM), Mattingly Publishing Co, vol-83, pp- 17118-17125, APR 2020.**

32. **Subrat Kumar Pradhan, Swarna Prabha Jena, Debaraj Rana, "IOT Based Smart Garbage System for Efficient Waste Management", Test Engineering and Management (TEM), Mattingly Publishing Co, vol-83, pp- 17641-17649, APR 2020.**

33. **Ramachandran, Chandra Sekhar Dash A. Thamilselvan, S. Kalpana, M. Sundararajan, "Rapid synthesis and characterization of pure and cobalt doped zinc aluminate nanoparticles via microwave-assisted combustion", Journal of Nanoscience and Nanotechnology, Volume 20, Number 4,. pp. 2382-2388(7) April 2020 (SCI-Impact Factor: 1.354)**

34. **Yuvraj, A C Fernandez, M. Sundararajan, C. S Dash, P. Sakthivel, "Hydrothermal Synthesis of ZnO-CdS nanocomposites: Structural, Optical and Electrical Behaviour", Ceramics International, Vol. 46, pp. 391-402, 2020 (SCI- Impact Factor: 3.8)**

35. **Yuvaraj, A. Thamilselvan, S. Ramachandran, S. Venkatesan, M. Sundararajan, Chandra Sekhar Dash, "Impact of Mg2+ ion on the structural, morphological, optical, vibrational and magnetic behavior of ZnAl2O4 spinel, J. Supercond Nov Magn 33, 1199–1206, Aprile-2020. (SCI- Impact Factor: 1.130)**

36. **T Dhiwahar,. M. Sundararajan, P. Sakthivel, C. S. Dash, & S. Yuvaraj,." Microwave-assisted combustion synthesis of pure and zinc-doped copper ferrite nanoparticles: Structural, morphological, optical, vibrational, and magnetic behavior", Journal of Physics and Chemistry of Solids, 138, 109257, Mar 2020.**

37. **Mitrakshi Mayurika Sahoo, Ritisnigdha Das and Chandra Sekhar Dash," A Review on State of Art Cryptographic Algorithms, Indian Journal of Natural Sciences, Vol 10 (59), 19341-19345.**

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3.2 Patents

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5. **Patent entitled with "INTELLIGENT SYSTEM FOR SATELLITE COMMUNICATION FROM LAND MOBILE NETWORK USING IOT AND METHOD THEREOF" filed on 26.07.2021 published on 06.08.2021, application number-202141033481.**

6. **Patent entitled with " AN IMAGE ANALYSIS DEVICE USING DEEP LEARNING DATA MODELLING AND THEREOF" filed on 25.08.2021 published on 03.09.2021, application number-202141038588.**

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10. **Patent entitled with "AN INTELLIGENT SYSTEM AND METHOD FOR THE SERVICE SECTOR ON THE NATION'S ECONOMIC GROWTH USING MACHINE LEARNING AND BLOCKCHAIN TECHNOLOGY", application number- 202231049007, filed on 27.08.2022, published 09. 09. 2022.**

11. **AI and IoT Based smart altering system for electric vehicles in smart cities using Machine Learning algorithms, application number-202231073063**

12. **Artificial Intelligence and IOT-based electric vehicles monitoring system, application number-202231057924**

13. **Iot based Data leakage prevention system for organizations and individuals, application number-202141061247**

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15. **Apparatus for Joining Dissimilar Copper to metal by pulsed Gas Tungsten Arc Welding,German Patent Application No: 20 2022 105 492.4**

16. **A Reliable and Durable Electric Go-Kart System, German Design Patent Application No: 202022106429.6**

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18. **Deep learning based system to analyse and support the process of cleaning solar separators in solar energy enabled devices for harvesting solar energy, Application No: 202211060209 A**

19. **Automated Portable Diagnostic System and Method for the Patients in Covid Hospitals, Application No: 202031035686**

20. **Method and Automated Safety Equipment for Quick Detection of Biological Events of Hospitalized Patents for Covid Thereof, Application No: 202031039046**

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3.3 Conference and Book Chapters

1. **Paper entitled "Wide Band Conformal Coplanar Benz Shaped Circular Ring Antenna for C and X- Band Application", International Conference on Computing, Communication and Power Technology (IC3P), IEEE Conference, 2022.**

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3.4 Internship & Workshop

1. **One Month internship on Embedded Systems and Robotics**
2. **Full Custom IC Design using Cadence Tool**
3. **Workshop on Build an IoT Application using 32-bit microcontroller.**
4. **Workshop on Geovia Surpac**
5. **2-Days Workshop on Application of Industrial Controller**
6. **Electric Vehicle: Design and Assembly**
7. **Biomedical Signal Analysis using MATLAB**
8. **PCB Design at a Glance**
9. **The Role of Additive Manufacturing in Engineering and Bio-medical Applications**
10. **Smart Farm Machinery Operation Training**

Figure 3.1: One Month Internship on Embedded Systems and Robotics

Figure 3.2: Workshop on Full Custom IC Design using Cadence Tool

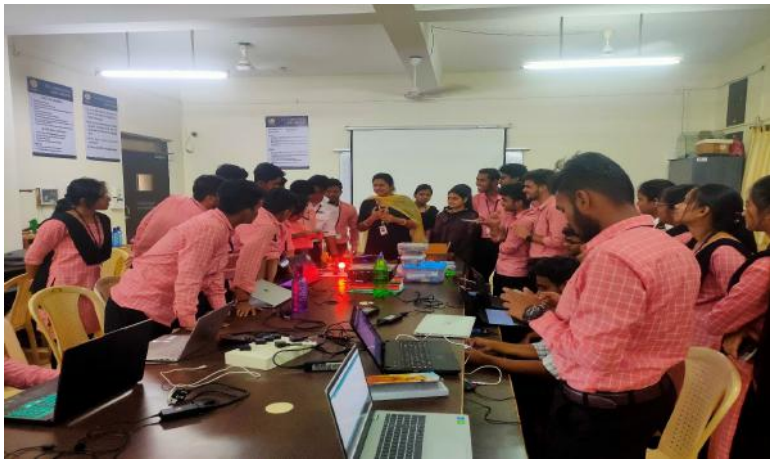

Figure 3.3: Workshop on Build an IoT Application using 32-bit microcontroller

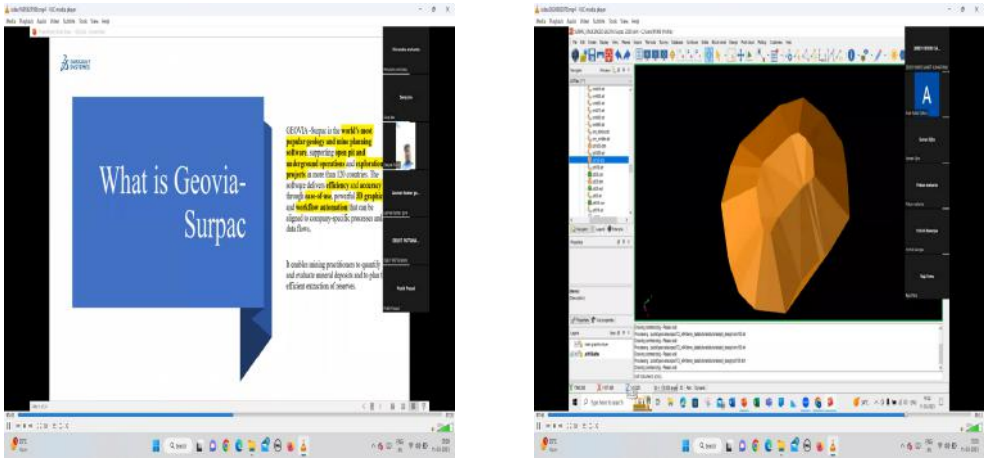

Figure 3.4: Workshop on Geovia Survac

Figure 3.5: 2-Days Workshop on Application of Industrial Controller

Figure 3.6: Workshop on E-Vehicle Simulation Design and Assembly

Figure 3.7: Workshop on Biomedical Signal Processing using MATLAB

Figure 3.8: Workshop on PCB Design

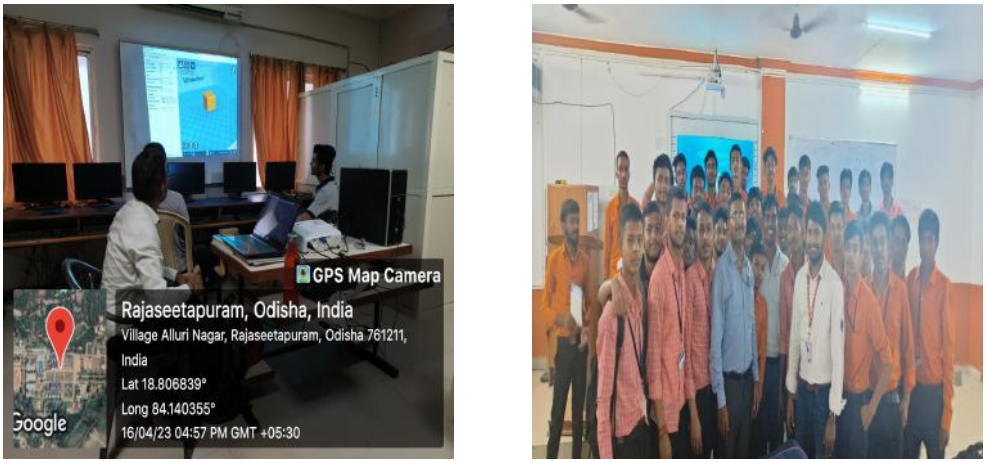

Figure 3.9: Workshop on the Role of Additive Manufacturing in Engineering and Biomedical Applications

Figure 3.10: Workshop on the Role of Additive Manufacturing in Engineering and Biomedical Applications

Figure 3.11: Workshop on Smart Farm Machinery Operation Training

3.5 CEO Retreat at Sai Resorts Vishakapatnam

Figure 3.12: CEO Retreat at Sai Resorts Vishakapatnam

3.6 Faculty Awards

- **Provost Award in the category of " Eminent Achiever Award"**
- **Certificate of Excellence for Publishing Patents**
- **Medal of honor**
- **Roll of Honour**

(a) Dr. Harish Chandra Mohanta receiving the award from VC, CUTM, Odisha

(b) Dr. Chandra Sekhar Dash receiving the award from Provost, CUTM, Odisha

(c) Dr. Sudhansu Sekhar Samal receiving the award from VC, CUTM, Odisha

(d) Mrs. Swarna Prabha Jena receiving the award from President, CUTM, Odisha

Figure 3.13: Awards & Honours

3.7 Future Plans

The centre tries to foster an inclusive, equitable, and diverse culture of excellence and continuous strategic improvement. Further, it attempts to leverage partnerships and collaboration with other Research centres to drive research and innovation. We thrive for translating and commercializing research findings for societal impact, which would advance the university's research brand and reputation.