This study's results demonstrate that drivers' level of aggression in different driving regimes is not constant, and characterizing the driver by means of abstract driving features is not indicative of diversified driving behaviour. The proposed method identifies the individualized driving behaviours, reflecting the driver's choice of driving manoeuvres, as shown in **Figure 13** & **Figure 14**. Thus, the insights from the study are highly useful for designing driver-specific safety models for driver assistance and driver identification.

Figure 13: (a) Instrumentation details; (b) Study vehicle; (c) Recorded speed and acceleration profiles; and snapshots of collected video data.

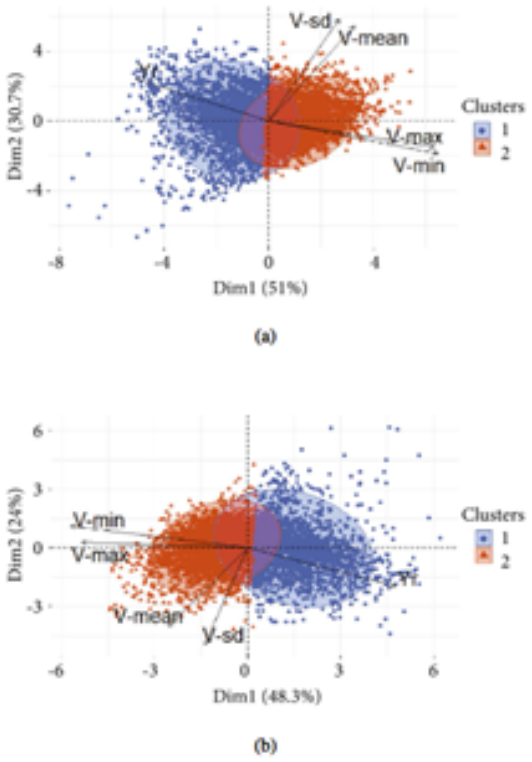

Figure 14: Cylindrical imperfection measured using DIC

Research Diary

Catalyzing Autonomous Navigation Design Thinking across India

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Introduction:
Drone (UAV) is probably the most exciting and widespread innovation today. Whenever and wherever a drone flies, it always catches our attention and excites our imagination towards autonomous drones doing a lot of work for us.

As Indians, an autonomous drone does not surprise us, thanks to the "Pushpak Viman" mythology of Ramayana – A flying machine that can go anywhere on command on autopilot, originally belonging to Kubera, the God of Wealth, stolen by Ravana, and restored back to its original owner by Lord Rama as illustrated in **Figure 15.**

In modern times, it is Tesla that has shown the world how autonomous navigation can happen in the real world and it works. As the market grows, more and more vehicle manufacturers are adopting autonomous navigation and driver aids in some form or other.

TiHAN-IIT Hyderabad is on this mission to accelerate autonomous navigation space in India by creating an atmosphere of innovation, training new talent to understand and implement solutions, and encouraging companies and start-ups to use its facilities to build and test terrestrial and aerial autonomous navigation enabled products.

Figure 15: Pushpak Vimana - India's 1st Autonomous Drone

Research Diary

OptimusLogic and TiHAN-IIT Hyderabad:
OptimusLogic Systems, since 2013, with operations in Hyderabad & Bengaluru in India, is now a growing global Original Device Manufacturer (ODM) and Independent Design House (IDH) in India for Mobile & Wearable AI systems, Industrial IoT solutions, Signal Intelligence Radars, and Ad-hoc Radios.

OptimusLogic has had an R&D partnership with IIT Hyderabad since 2016 to tap into the latest academic research & talent across engineering and research disciplines. OptimusLogic and TiHAN-IIT Hyderabad jointly develop solutions, training programs & kits for autonomous navigation in aerial and terrestrial vehicles.

Over the past quarter in 2022, TiHAN-IIT Hyderabad and OptimusLogic have worked together to create awareness and impact in the autonomous navigation space with:

- UAV, UGV Training Kits
- Training Programs
- "Vaman" for AI in Autonomous Navigation – 1st mass-produced academia-industry product in India, as shown in **Figure 15.**

UAV & UGV Kits:
TiHAN-IIT Hyderabad and OptimusLogic partnered to build Unmanned Ground Vehicle (UGV) & Unmanned Aerial Vehicle (UAV) kits designed explicitly for Skill Development Activities of Hub and facilitate the commercial availability from industry partners of UGV & UAV kits, as shown in **Figure 17 & Figure 18**, which will benefit utilization by target institutes, industry, and student enthusiasts.

In an industry-academia co-operation first, the partnership created commercially viable kits that enable learning and skill development, as well as to maintain the revenues to keep the program sustainable for long-term goals.

These kits, along with the training programs, enable participants to:

- Understand and learn industry focus for better jobs across:
- Hardware • Software • Firmware • VLSI • FPGA • AI+ML Applications
- Wireless RF • System Design • Assembly • Debug • Testing using
- C • Python • Java • Android • Linux • Windows • RPi • Arduino
- Build a working UAV/UGV system from scratch and understand each component across multiple engineering streams
- Prepare and get a direction for industry jobs and career opportunities

Kits can be bought and leased from Optimus Electronics, a distributor for OptimusLogic systems, by email at vaman@optimuselectronics.com or by contacting the coordinator at the IIT Hyderabad campus at +91-9606706303. Online sales are coming soon.

Training programs:
TiHAN-IIT Hyderabad conducted multiple workshops across engineering colleges, where participants – that included teachers and students experienced the joy of building and testing their own UAVs and UGVs, as depicted in **Figure 19** (from L-R-B: Students from Anurag University, Hyderabad, NIT, AP, Tadepalligude, and CBIT, Hyderabad.

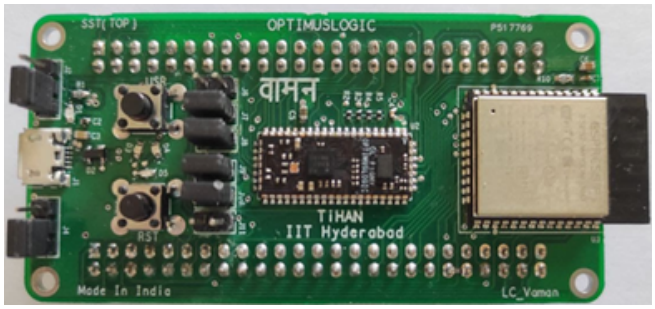

Figure 16: TiHAN-IIT Hyderabad OptimusLogic "Vaman" Board

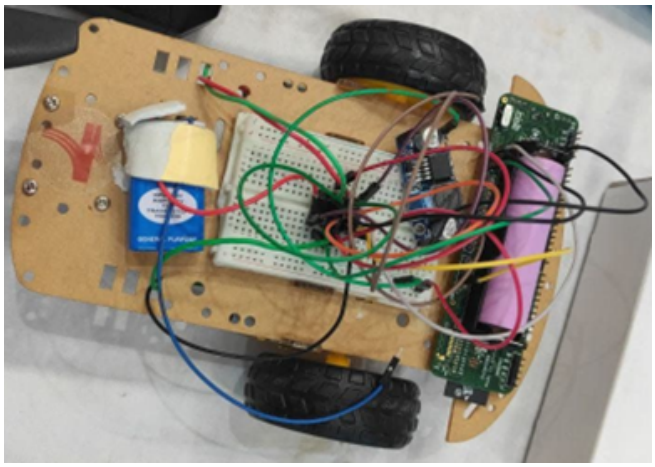
Figure 17: LCS assisted IFVs & Ocean Networks using Private 5G

Figure 18: LCS assisted IFVs & Ocean Networks using Private 5G


Figure 19: Students Building & Testing their own UAVs & UGVs

Vaman (वामन) for AI in Autonomous Navigation:
TiHAN-IIT Hyderabad, in association with OptimusLogic Systems India, launches the **"Vaman"** range of affordable **Made-in-India** boards to enable innovation in autonomous navigation systems in UAVs/UGVs through a significant impact across the engineering curriculum and mindset and contribute to the rising semiconductor ecosystem in India and the world.

TiHAN-IIT Hyderabad's **"Vaman"** redefines what can be achieved with Industry-Academic cooperation for a single Board, mixed with passion and commitment to Open Source coupled with local affordable design & manufacturing.

The VamanLC 1.0 Board features:

- The "Pygmy" as shown in **Figure 20**, FPGA+ARM+AI Module, Made-in-India, made by OptimusLogic
- Espressif ESP-32 WiFi+BLE Module to provide wireless connectivity and programming
- Micro-USB Port for Power, Programming, and Wired Interfacing
- 50+50 (100) 2.54mm Pins for a wide variety of uses and flexibility
- 100% Open-Source VLSI, Hardware, Software, and AI/ML Tools chains that run on Android, Raspberry Pi, Laptop, and PC

  o VLSI & Hardware:
  - Google-supported QuickLogic Corporation's Open Reconfigurable Computing (QORC)
  - Symbiflow, Yosys RTL Synthesis, VPR Place/Route
  - KiCad PCB Design

  o Embedded Systems & AI/ML
  - GCC, Zephyr RTOS, FreeRTOS
  - TensorFlow Lite, SensiML
- Local Manufacturing & Support System for scale and supply
- Industry Relevant Training to target semiconductor career opportunities

The TiHAN-IIT Hyderabad VamanLC Board uses tools that can run on your Android Phone without needing a Laptop/PC, increasing its reach across the country and cutting across economic and social divides. Anyone now can learn, master, and build solutions to real-world problems with a hardware-software co-design thought process from prototypes to products.

The Vaman LC can be used as a learning platform to deliver industry-relevant content suitable for career development in the Semiconductor & Electronics industry across Graduate/Post-Graduate Engineering & Science Disciplines (IIT Hyderabad has used it for courses since 2021):

- Hardware, Software, Firmware Co-Design
- Digital Design, VLSI, FPGA
- DSP Design & Implementation
- AI+ML Applications
- System Design
- Assembly
- Debug
- Testing & Validation

The Vaman LC serves as a ready platform used for the development of products such as:

- Systems in UGVs, UAVs
- Wearable AI Systems
- Consumer & Industrial IoT
- Low Power Ad-hoc Communication

The VamanLC Board is the first product of long-term global academic-industry cooperation in India, with IIT Hyderabad (under the aegis of Dr GVV Sharma), TiHAN (under the aegis of Dr Rajalakshmi Pachamuthu & Mahesh Balaiah Aswathaiya), OptimusLogic Team (led by Chandrakumar Chettiar, Someshwar MS, Krishnakumar A) and QuickLogic Corporation (led by Brian Faith & Tarachand Pagarani).

VamanLC Board complements the TiHAN-IIT Hyderabad UAV/UGV Kits for advanced learning and development.

Figure 20: OptimusLogic's Pygmy Stamp

Based on the success of "Vaman" products, OptimusLogic and IIT Hyderabad are working for India's 1st homegrown 5G Global mobile phone, coming in 2023.