

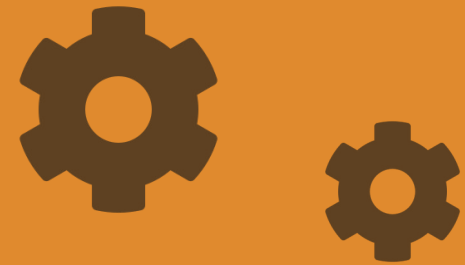
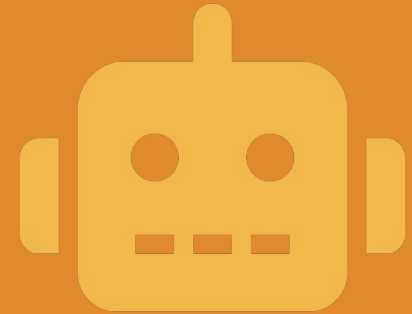
INTERNSHIP LOG

Rhythmsoft Robotics and Automation

Exploring Industrial Robotics & Automation

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IB Diploma Programme · Oberoi International School, Mumbai



Mentor: Mrs. Vasudha Chandratre · Nashik, Maharashtra · June 30 – July 4, 2025

Internship Overview

A 5-day immersion into industrial robotics and automation at Nashik

 Duration	 Mentor	 Location	 Sector
June 30 – July 4, 2025 5 Working Days	Mrs. Vasudha Chandratre Rhythmsoft R&A, Nashik	Nashik Manufacturing Facility Maharashtra, India	Industrial Robotics & Automation



"The objective of this internship is to gain first-hand exposure to industrial robotics and automation in a manufacturing environment — understand how engineers develop and deploy robotic solutions for shop-floor applications, and explore the interdisciplinary nature of mechanical, electrical, electronics, and software engineering in modern industrial automation."

Day 1 Orientation	Day 2 Machines	Day 3 Robotics	Day 4 Live Floor	Day 5 Debrief
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Learning Objectives

What I set out to understand and explore

1



Role of Automation

Why factories use robots; tasks automated vs human; benefits in productivity, consistency & safety.

2



Engineering Design

How engineers identify problems, conceptualise robotic solutions, test and iterate — balancing cost, complexity and performance.

3



Industrial Robotics

Robot types and applications; key components — mechanical structure, actuators, sensors, controllers, end-effectors.

4



Control & Programming

How robots receive instructions; PLCs, sensors, industrial communications; basic motion programming & control.

5



Shop Floor Experience

Production workflows; quality control; safety protocols around automated equipment; team collaboration.

6



Career Paths & Skills

Interact with mechanical, electrical & software engineers; understand skills per discipline; project lifecycle from concept to deployment.

Three Big Questions:

- ① What problem is the robot solving? ② How do engineers turn an idea into a working machine? ③ How does automation change the way a factory operates?

About Rhythmsoft Robotics and Automation

Company Overview • Established 2000 • Nashik, India



6

Countries



250+

Employees



400+

Installs



100%

Solar

Key Customers:



Overview

Founded in 2000 by Mr. Pritish Chandratre, Rhythmsoft Robotics and Automation has grown into one of India's leading suppliers of turnkey robotics and automation solutions for major automotive OEMs globally. The company's ability to customise solutions to each customer's unique needs sets it apart.

Solutions Portfolio

Press Shop Automation

Body Shop Automation

Paint Shop Automation

Closure & Hemming

Powertrain Automation

Final Assembly

BIW / CCB Lines

Glass Gluing

Rail Systems

Values`

Integrity • Trust • Excellence • Passion for Growth • Spirit of Partnership



Rhythmsoft's facility operates on 100% solar energy — reflecting a commitment to net-zero manufacturing and environmental leadership.

Milestones & Nashik Facility

25 Years of Growth • Primary Engineering & Fabrication Centre

25 Years of Growth

2000	2008	2015	2020	2025
Founded	Going Global	New Divisions	Industry 4.0	25 Years
Founded by Mr. Prithish Chandratre in Nashik, focused on automotive robotics.	First global OEM customer onboarded; crossed 100 turnkey installations.	Dedicated Body Shop & Press Shop automation practices launched.	250+ employees; solar-powered facility; IoT solutions launched.	400+ installs; 6 countries; 100% solar; global automation leader.

Nashik Facility — Our Primary Engineering, Fabrication & Testing Centre

 Location & Role	 Technologies On-Site	 Industry 4.0
Nashik, Maharashtra — a key western India industrial hub. Serves as the primary engineering, fabrication, robot integration, and quality inspection facility.	MIG, Spot, Laser & Stud welding robots; Robotic Flaming; Vision Systems; End-of-Arm Tooling (EOAT) design & manufacture on-site.	IoT-enabled monitoring & real-time data analytics integrated into production lines — placing the facility at the frontier of smart manufacturing.
 Global Reach	 Awards & Recognition	 Customer Focus
Solutions deployed to automotive OEMs across India, Europe, and South-East Asia — 6 countries served with 400+ turnkey installations.	Multiple awards received for exceptional engineering and leadership — recognised across the automotive automation industry in India and globally.	Rhythmsoft's competitive edge: ability to fully customise automation solutions to each OEM's unique manufacturing challenges and specifications.

Orientation, Factory Tour & Internship Plan

Day-by-Day Schedule • June 30 – July 4, 2025

Day 1

Jun 30

Orientation & Factory Tour

Company intro by Mrs. Vasudha Chandratre • Walkthrough of Nashik facility • Safety protocols & PPE briefing • Overview of automation divisions • Company history & milestones

Day 2

Jul 1

Machines & Tools Workshop

Manual Milling Machine • BFW Advanced Milling Machine • DRO / Drill Machine • Lathe & Tapping Machines • Precision measurement & calipers

Day 3

Jul 2

Advanced Machines

BatilBoy / HyCUT semi-auto machine • Flame Cutting (LPG + Oxygen) • Band Saw Machine (2 blade types) • Painting & surface treatment • VMC / CNC machines

Day 4

Jul 3

Robots & Clamping

KUKA 6-axis industrial robot • Teaching pendant & control box • Robot modes (T1, T2, AUTO, E) • Motion & point-to-point programming • Air pressure clamping

Day 5

Jul 4

Electrical Systems & Debrief

Control panel & PLC • Isolation transformer, relays & grounding • Load types & power factor • 3-phase power, circuit breakers, AC/DC • Review, feedback & reflection

Key Observations — Day 2

Machines & Tools Workshop



Milling Machine (Manual)

- Operated by manual labour; trims components to desired length & width
- Works only in X-Y plane (2-axis operation)
- Slow process; sandpaper used for final edge smoothing
- Heat & cut-resistance gloves required at all times



BFW Advanced Milling Machine

- X, Y and Z planes — fully adjustable; trims parts faster than manual
- Can perform fillets; special oil + water coolant for smooth finish
- Plastic cover prevents material fly-off during operation
- Digital ruler used after each cut to verify accuracy



DRO Milling / Drill Machine

- Drills holes in many material types; operator sets origin on-screen
- 3-stage drill sequence: Centre drill → Pilot hole → Reamer (if large hole)
- 4 gear modes: Front Fast / Slow, Back Fast / Slow — larger drill = slower gear
- Water + oil coolant: prevents rust (water alone) & stickiness (oil alone)



Lathe & Tapping Machines

- Lathe: spins material at high speed to trim and shape circular profiles
- Controls inner & outer radius; 2 knobs — width control & trim layer depth
- Tapping: threads holes so nuts & screws can be placed and seated
- Tapping oil (soft/slippery) used — keeps thread intact unlike standard coolant

Key Observations — Day 3

Advanced Machines & Processes



BatilBoy / HyCUT — Semi-Automatic Milling & Drilling

- Semi-automatic; does both drilling and milling — drill stays fixed, platform moves in X, Y, Z
- Operator codes the machine on-screen: sets origin at corner of material, then programs cuts
- For milling >0.5mm multiple cycles used — 1st cycle rough cut, subsequent cycles trim to required length
- Always 2 milling cycles: 1st cut fast (rough), 2nd cut ≤0.5mm slow (clean finish) — same approach used in VMC
- Speed = motor rotation speed; Feed = table movement speed — speed and feed must always match
- Has a side drill for horizontal cuts; gearbox with manually changeable speed (no front/back gear)



Flame Cutting Machine

- LPG + pressurised oxygen used to cut large and thick metal pieces
- 2 tanks: Tank 1 = LPG, Tank 2 = oxygen released at 5–6.5 bar (varies with material thickness)
- Combined LPG + burning oxygen can cut material up to 100mm thickness
- Semi-automatic: after placing metal, operator codes the cut — most metal cut in one cycle
- After cutting, material transported via metal pipe conveyor (extremely hot — no hand contact)



Band Saw Machine

- Cuts metal pipes, rods, and pillars — chops ends off metals; cannot trim or make holes
- Metal clamped to machine first; correct bandsaw type selected before starting
- 2 bandsaw types: Type 1 = big teeth for thick/solid metals; Type 2 = small teeth for cylinder pipes
- Wrong saw type will damage the blade — selection is critical to tool life
- 2 cooling oil jets on both ends of saw running continuously; oil recycled twice before disposal



Painting & Surface Treatment Process

- Step 1: Remove rust (grinder) and welding marks (small metal hammer) from metal surface
- Step 2: 1L phosphoric acid diluted in 3L water applied to remove residual rust and oil
- Step 3: Grey/white primer applied (white primer for yellow final colour); filler used for dents/holes
- Step 4: 1 day drying time; then 2 glossy paint layers applied simultaneously
- Step 5: Special paper rubbed on finished paint surface for smooth final finish
- Mix: 4L paint + 1L binder ensures paint bonds to primer and doesn't peel off

Key Observations — Day 3 (cont.)

Precision Machines & Measurement



VMC — Vertical Machining Centre

- Comes in all sizes; cuts large metal pieces fast and with great accuracy
- Moves on X-Y plane both vertically and horizontally in the same arc
- Metal loaded at a very specific angle; pre-coded program controls all drill cuts/trims
- Many coolant oil jets thrown continuously at the area being cut during operation
- Similar two-cut technique as BatilBoy: 1st cut fast (rough), 2nd cut slow (clean finish)



CNC Machine — Computer Numerical Control

- Used to cut and trim round metal cylinders with great accuracy and speed
- Functions as an automated lathe — pre-coded program trims material to its desired shape
- Metal cylinder placed first; pre-coded program runs automatically without operator input
- Cooling oil jets used throughout the process to speed up cutting and protect the tool
- A ruler used in these factories is called a caliper — digital readout = digital caliper

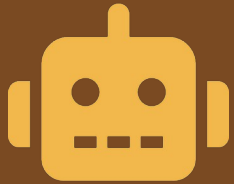


HyCUT (Manual) & Grinder

- HyCUT: manual machine for drilling and milling — drill fixed, platform moves in X, Y, Z
- Platform moves digitally and physically; digital display shows position — similar to DRO machine
- Also shows Z plane position (unlike the basic drilling machine which only shows X and Y)
- Side drill hole on Y plane enables horizontal/sideways cuts, trims, and holes
- Grinder: hand tool used to smooth rough metal surfaces and remove weld splatter and rust

Key Observations — Day 4

The KUKA 6-Axis Industrial Robot



KUKA Robot

6-Axis Industrial Arm

- Main robot used on the shop floor
- 6 main axes — full 3D reach & articulation
- Controlled via a teaching pendant
- Pendant connects to a control box / panel
- Pendant holds NO data — control box stores it
- 4 deadlock buttons must be held to move
- 3 green play buttons start the robot



4 Operating Modes

- T1 — train the robot at safe slow speed
- T2 — test (not train) at faster speed
- AUTO — runs automatically, minimal human input
- E — external / expert mode



4 Ways to Move the Robot

- 6-Axis — control all 6 axes individually
- X, Y, Z — pick direction, robot moves accordingly
- Centre Tools — move via tool on 6th axis (hard angles)
- Joystick — move robot per selected mode



Point-to-Point Programming

- PTP — shortest path between 2 points (displacement)
- LIN — always a straight line (distance)
- CIRC — smooth curve between points (rarely used)



Coding Functions

- LOOP / REPEAT — repeat pattern until condition met (e.g. $P=0$, $P=P+1$, UNTIL $P==4$)
- GOTO — skip lines: write GOTO X, resume at label X:

Key Observations — Day 4 (cont.)

Air Pressure Clamping System

How It Works

- Air pressure generated by a compressor
- Used to close & tightly secure clamps for tasks like welding
- Holds the workpiece firmly to the surface during operation

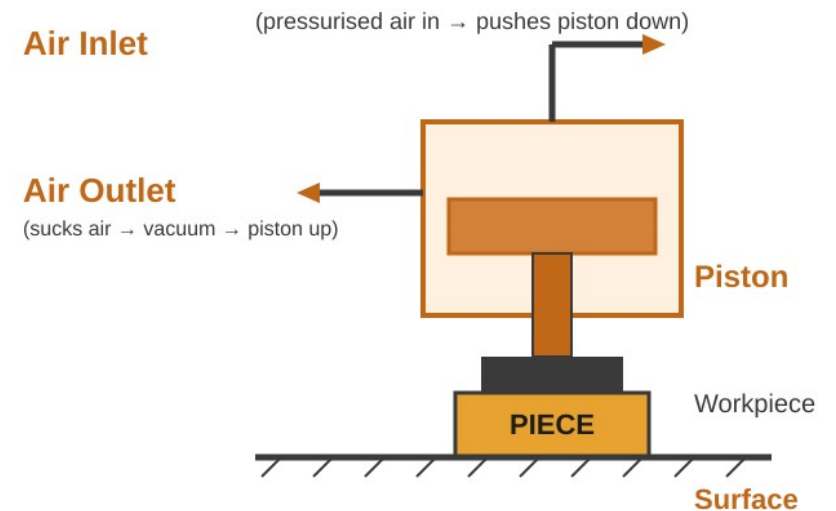
Two Pipes Per Clamp

- Pipe 1 — clamps: throws pressurised air to close the clamp
- Pipe 2 — declamps: receives air to release the clamp

The Clamping Cycle

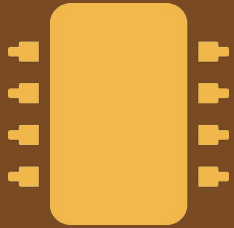
- Air inlet lets pressurised air in → pushes piston down → clamps piece to surface
- Air outlet sucks air out → creates vacuum → pulls piston back up to release

Air Pressure Clamping — How It Works



Key Observations — Day 5

Electrical Systems • The Control Panel & PLC



The Control Panel

Brain of the Robot's Electricity

- Electrical box controlling all power to a robot
- Houses circuit breakers, PLC, transformers, switches
- Human interface screen shows total voltage & all 3 phases
- Connectors on both sides = input & output for wires
- Main breaker disconnects all power; miniature breakers per part



PLC — Programmable Logic Controller

- The core of the control panel
- Holds all the code & tells each part when to function
- Directs the correct voltage to each device (e.g. 24V to Robot A, 12V to Robot B)



Isolation Transformer

- Protects the expensive PLC from damage
- Not a step-up / step-down transformer
- Removes any spike in the current to keep supply stable



Power Relays

- Switch the robot's power supply on or off
- Many relays — each controls a major part of the robot
- Emergency switch trips a relay → cuts all power to robot
- The main hub of the wiring — if relays fail, the system stops



Grounding Bars

- Ensure all wires are grounded properly
- Without grounding, fault current has nowhere to go
- Prevents current build-up, electrocution & magnetised metal
- Protects fragile components — PLC, transformer, etc.

Key Observations — Day 5 (cont.)

Electrical Theory • Loads, Power Factor, 3-Phase & AC/DC



Three Types of Load

- Inductive — anything with winding (copper wire, motors)
- Capacitive — raises power factor, reducing power needed
- Resistive — pure resistance loads



Power Factor

- The angle between the voltage wave and the current
- Higher power factor → more efficiency, less electricity used
- A capacitor raises the AC power factor
- DC current always has a power factor of 1



3-Phase Power

- 3 phases — X,Y,Z or A,B,C (same thing, different names)
- Phases are spinning pipes, aligned 120° apart
- Same voltage & current; far more efficient for large loads
- Homes use 1 phase; factories use 2 or 3 phases



Circuit Breakers

- Tripping mechanism preventing overheating & damage
- Detects faults via electromagnets or bimetallic strips
- Prevents overload and short circuits
- Spring mechanism physically separates the conductor



AC vs DC & The Inverter

- AC is used in most places — less energy loss than DC
- AC provides stable energy for homes
- An inverter converts DC → AC (uses MOSFETs inside)



Why It Matters

- Electrical systems power & protect every robot
- Right voltage, grounding & protection keep equipment safe
- Efficiency (power factor, 3-phase) reduces running cost

What This Internship Made Me Think

01

The Full Lifecycle of a Machine

Gained an end-to-end perspective of how a machine is conceived, designed, fabricated, assembled, and deployed — from raw material to working robotic system on a live shop floor.

02

From Mechanical to Electrical

The journey moved from mechanical processes — milling, drilling, tapping, lathe work — through robotics and into the electrical systems (PLCs, control panels, 3-phase power) that bring every machine to life.

03

Machines Are Problem-Solvers

Every machine, robot, and automated system existed to solve a specific human problem — consistency, speed, safety, or precision. That framing changed how we look at engineering as a discipline.

04

Desire to Work with Machines

This internship strengthened curiosity and desire to work in the world of machines — reinforcing interest in robotics, IoT, and the intersection of hardware and software engineering.



5 Days · Nashik

June 30 – July 4, 2025

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