



## Virtual Labs: Making Engineering Education Engaging, Enjoyable, Immersive and Online

### WHAT ARE VIRTUAL LABS?

The Virtual Labs project is an initiative of MoE, Govt. of India. The objective of the project is to benefit:

- All students and Faculty Members of Science and Engineering Colleges who do not have access to good lab-facilities and/or instruments.
- High-school students, whose inquisitiveness will be triggered, possibly motivating them to take up higher-studies.
- Researchers in different institutes who can collaborate / share equipment and resources.
- Different engineering colleges, who can benefit from the content and related teaching resources.

### COLLABORATORS OF VIRTUAL LABS AND DISCIPLINES

#### Institutes

1. IIT Delhi (coordinating institute)
2. IIT Kanpur
3. IIT Bombay
4. IIT Kharagpur
5. IIT Guwahati
6. IIT Roorkee
7. IIIT Hyderabad
8. Amrita University
9. Dayalbagh University
10. NIT Surathkal
11. COE Pune

#### Disciplines

- Electronics and communication Engineering
- Computer Science and Engineering
- Electrical Engineering
- Mechanical Engineering
- Chemical Engineering
- Biotechnology and Biomedical Engineering
- Civil Engineering
- Physical Sciences
- Chemical Sciences

### OUTREACH PROGRAMS

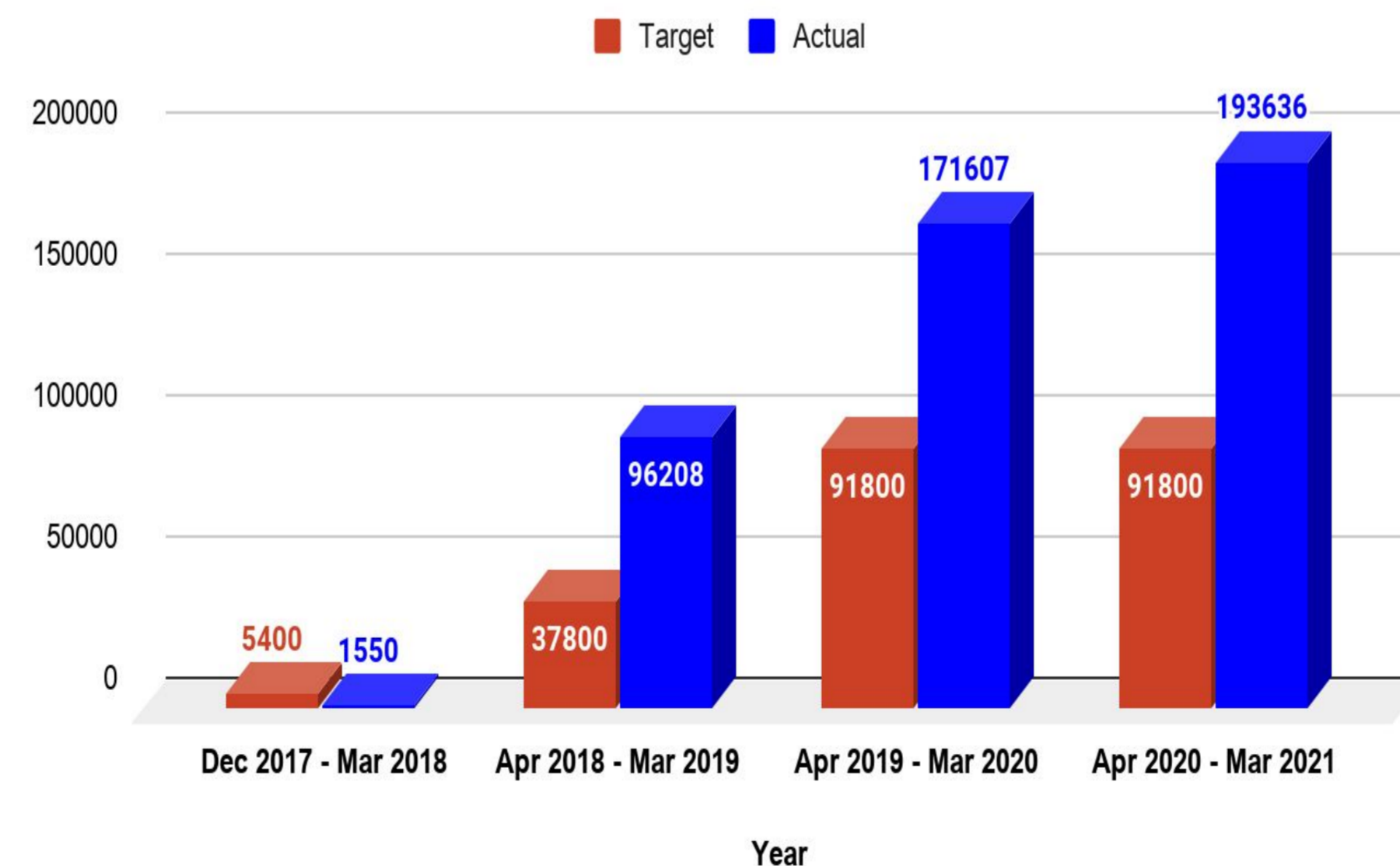
1. Standard Outreach Program - via NCs, IEEE Associates and IIIT Workshops
2. Off Cycle Internship Program - For undergraduates across the state
3. Experiment Development Program - Request for proposals from colleges

### OUTREACH TARGET (DEC 2017 - MAR 2021)

Year	Usages		Workshop		Nodal centers	
	Target	Actual	Target	Actual	Target	Actual
Dec 2017 - Mar 2018	5400	1550	5	37	5	6
Apr 2018 - Mar 2019	37800	96208	15	41	15	22
Apr 2019 - Mar 2020	91800	171607	25	70	25	23
Apr 2020 - Mar 2021	91800	193636	25	91	25	33

### OUTREACH PERFORMANCE (DEC 2017 - MAR 2021)

#### Cummulative Usage Targets Vs Actuals



### Announced Internship Programs

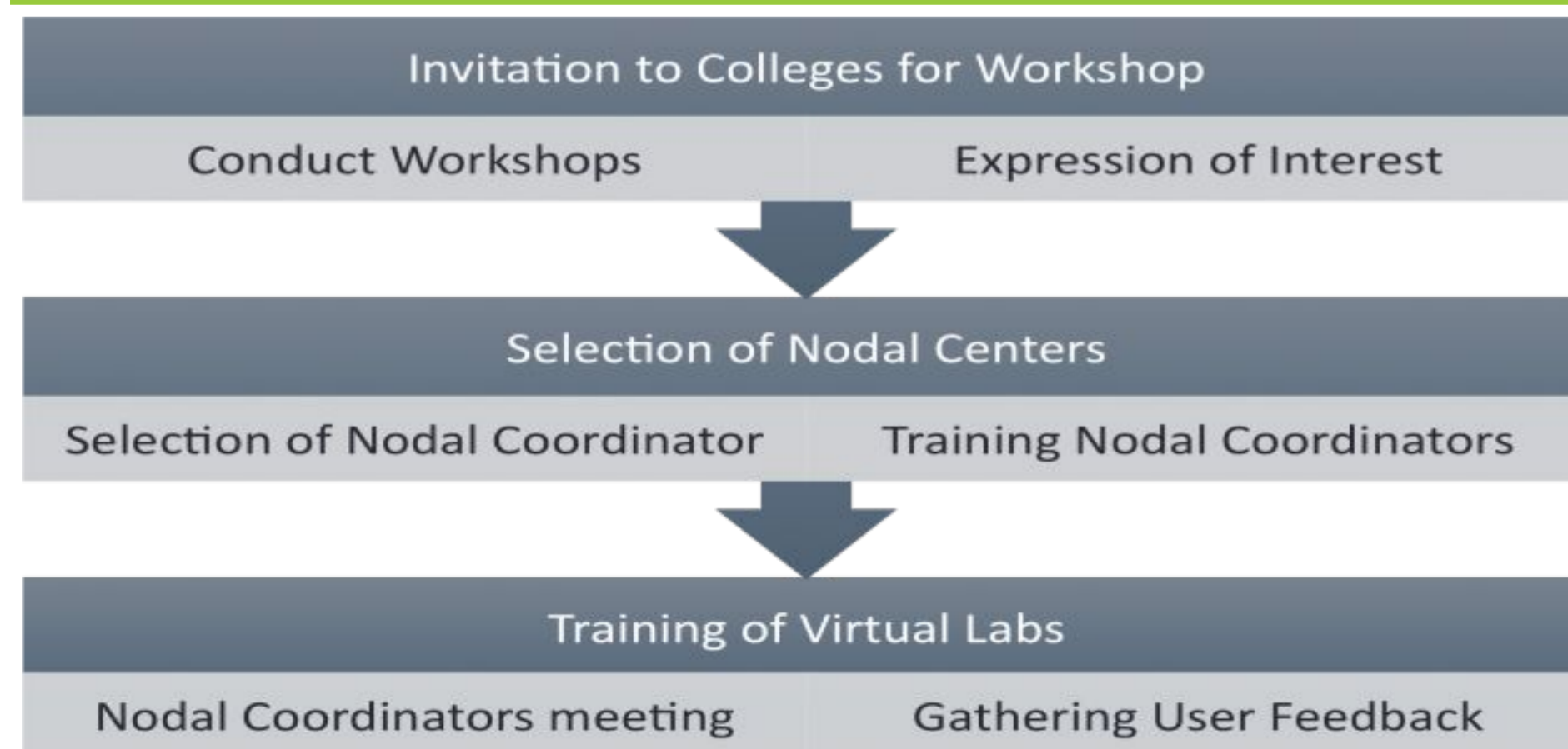
Internship Phase	Participation in Numbers	Participation - Student Numbers	
		Internship 1 May - Jul 18	Internship 2 Nov 18-Mar 19
1 Registered	6 NC/ 26 NC+ Others	92	975
2 End of Phase 1	6 NC/ 26 NC+ Others	26	292
3 Shortlisted for Phase 2	6 NC/ 26 NC+ Others	26	220
4 Attended Boot Camp phase 2	6 NC/ 26 NC+ Others	15	67
5 Completed Internship	6 NC/ 26 NC+ Others	13	47

### NEW EXPERIMENTS DEVELOPMENT

#### Progress from Dec 2017 to Mar 2021

S.No.	Period	Status
1	Dec 2017 - Mar 2018	Planning & Pedagogy Definition
2	Apr 2018 - Mar 2019	23 Experiments approved by LDC 8 experiments completed & under review 12 under development
3	Apr 2019 - Mar 2020	23 Experiments completed. Testing and Audio recording in progress
4	April 2020- Mar 2021	23 Experiments hosted. Used by 100k Users with 1M pageviews. Most popular CS lab.

### OUTREACH MODEL



Data Structure Lab-I	Data Structure Lab-II
<b>Linked List</b> <ul style="list-style-type: none"> <li>• Linked lists: single and doubly linked lists</li> <li>• Polynomial Arithmetic using linked lists</li> </ul>	<b>Sorting</b> <ul style="list-style-type: none"> <li>• Selection Sort</li> <li>• Radix Sort</li> </ul>
<b>Stacks and Queues</b> <ul style="list-style-type: none"> <li>• Stacks and Queues: with arrays and linked lists</li> <li>• Infix to Postfix conversion, evaluation of Postfix expression</li> </ul>	<b>Graphs</b> <ul style="list-style-type: none"> <li>• Topological sort</li> <li>• Minimum spanning tree</li> <li>• Path algorithms: Dijkstra's shortest path</li> </ul>
<b>Searching</b> <ul style="list-style-type: none"> <li>• Unsorted Arrays vs. Binary search in sorted Arrays</li> <li>• Hashtables: Search, insertion and deletion</li> </ul>	<b>Search Trees</b> <ul style="list-style-type: none"> <li>• Self balancing search trees: 2-3 tree</li> <li>• Self balancing search tree: red-black tree</li> </ul>
<b>Sorting</b> <ul style="list-style-type: none"> <li>• Merge Sort: algorithm and complexity</li> <li>• Quick Sort: algorithm and complexity</li> <li>• Heap Sort: algorithm and complexity</li> <li>• Bubble Sort: algorithm and complexity</li> </ul>	<b>Strings</b> <ul style="list-style-type: none"> <li>• Tries and Suffix Trees</li> <li>• Substring search: KMP algorithm</li> </ul>
<b>Trees</b> <ul style="list-style-type: none"> <li>• Binary Trees: Recursive and iterative traversals</li> <li>• Binary Search Tree: Construction, insertion, deletion and search</li> </ul>	
<b>Graphs</b> <ul style="list-style-type: none"> <li>• Graph Traversal: Depth First Search</li> <li>• Graph Traversal: Breadth First Search</li> </ul>	

