SSBT's College of Engineering and Technology, Bambhori Jalgaon
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A Seminar on

Turbocharging Innovation: AI-Powered Hybrid Boost Technology

Activity Report

Academic Year	2024-25
Program Driven by	A Seminar on Turbocharging Innovation: AI-Powered Hybrid Boost Technology
Quarter	II
Program / Activity Name	A Seminar on Turbocharging Innovation: AI-Powered Hybrid Boost Technology
Program Type	
Program Theme	Innovation and startups
Start Date	13-02-2025
End Date	13-02-2025
Duration of the Activity (in Mins)	90
Number of Student Participant	60
Number of Faculty Participant	70
Number of external Participant	--
Expenditure Amount in Rs.	
Any Remark	--
Mode of Session Delivery	Offline
Objective	
Benefit in terms of Learning / Skills / Knowledge obtained	
Feedback	
Video url (mp4)	
Photograph 1 (jpg)	Attached
Photograph 2 (jpg)	Attached
Overall report of the Activity (pdf)	As given below

Dr. P. H. Zope

Convener IIC

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Longitude	75.502675	75°30'9" E

Turbocharging Innovation: AI-Powered Hybrid Boost Technology

Introduction

Turbocharging has long been a critical innovation in enhancing engine performance, efficiency, and power output. With the integration of Artificial Intelligence (AI), hybrid turbochargers are evolving to provide unprecedented levels of optimization, fuel efficiency, and reliability. AI-powered hybrid boost technology represents a breakthrough in automotive and industrial applications, allowing for real-time adaptive control, predictive maintenance, and enhanced performance.

The Evolution of Turbocharging

Traditional turbochargers utilize exhaust gases to drive a turbine, which compresses the intake air to increase engine power. Hybrid turbochargers incorporate an electric motor to

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supplement the turbo boost, reducing lag and improving overall efficiency. The integration of AI further refines this system by enabling:

- **Real-time adaptive control** for optimal turbo boost management.
- **Predictive analytics** to enhance reliability and reduce mechanical stress.
- **Machine learning models** that adjust performance based on driving conditions.

AI Innovations in Hybrid Turbocharging

The application of AI in hybrid turbochargers introduces several cutting-edge advancements:

1. Real-Time Performance Optimization

- AI algorithms analyze engine parameters and driving conditions to adjust turbo boost dynamically.
- Optimized airflow and fuel injection enhance power output while reducing emissions.

2. Predictive Maintenance and Fault Detection

- AI-powered sensors monitor wear and tear, predicting failures before they occur.
- Maintenance schedules are optimized, reducing downtime and operational costs.

3. Reduction of Turbo Lag

- AI-assisted hybrid electric motors provide instant boost, eliminating traditional turbo lag.
- Machine learning models adapt boost delivery for smoother acceleration and improved drivability.

4. Enhanced Fuel Efficiency and Emissions Control

- AI-driven adjustments improve combustion efficiency, reducing fuel consumption.
- Adaptive emission control mechanisms ensure compliance with environmental regulations.

Real-World Applications of AI-Powered Hybrid Turbochargers

1. Automotive Industry

- AI-optimized turbochargers enhance performance in sports cars, electric hybrids, and commercial vehicles.
- Intelligent boost control adapts to different driving conditions, optimizing fuel economy.

2. Aerospace and Aviation

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- AI-driven turbocharging improves the efficiency of aircraft engines, reducing fuel consumption and emissions.
- Predictive maintenance systems increase aircraft reliability and safety.

3. Industrial Machinery and Power Generation

- AI-powered turbochargers optimize performance in heavy-duty machinery and power plants.
- Energy efficiency improvements contribute to cost savings and sustainability efforts.

Future Prospects of AI in Turbocharging

As AI continues to evolve, its role in turbocharging technology is expected to expand with:

- **Integration with IoT and Cloud Computing** for remote monitoring and diagnostics.
- **Advanced AI-driven Aerodynamics** to further improve turbocharger design.
- **Autonomous AI-Tuning Systems** that learn and adapt to individual driver preferences.

Conclusion

AI-powered hybrid boost technology is revolutionizing turbocharging by introducing intelligent control systems that enhance performance, efficiency, and durability. The combination of AI, hybrid electrification, and predictive analytics paves the way for more sustainable and high-performance engine solutions. As industries continue to adopt AI-driven turbocharging, the future of transportation and power generation will be shaped by smarter, more efficient, and environmentally friendly innovations.

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