



GLOBAL JOURNAL OF RESEARCHES IN ENGINEERING: F
ELECTRICAL AND ELECTRONICS ENGINEERING

Volume 25 Issue 1 Version 1.0 Year 2025

Type: Double Blind Peer Reviewed International Research Journal

Publisher: Global Journals

Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Overheating and Cooling Methods in Gaming Laptops: Literature Review and Practical Solutions (Case Study of HP Victus 15)

By Qurbonnazar Xolmamatov

Abstract- Laptops have become an integral part of academic and professional life; however, their compact design often leads to overheating, especially under heavy workloads such as gaming or computational tasks. This paper examines the overheating problem in modern laptops, focusing specifically on the HP Victus 15 model, and reviews both practical and advanced cooling methods. Practical solutions such as dust cleaning, thermal paste replacement, use of external coolers, and optimization of fan speeds using the Taguchi method are highlighted as effective measures, shown to reduce internal temperatures by 5–15°C. Advanced approaches such as GPU memory throttling, Phase Change Materials (PCM), nanofluids, and graphene-enhanced heat exchangers are analyzed for their potential in future laptop designs. Findings from existing studies and user experiences demonstrate that simple methods are affordable and immediately applicable for students, while scientific approaches ensure long-term improvements in thermal management.

Keywords: laptop overheating, HP Victus 15, cooling methods, taguchi method, phase change material, thermal management.

GJRE-F Classification: LCC Code: TK7887.8.M5



Strictly as per the compliance and regulations of:



RESEARCH | DIVERSITY | ETHICS

Overheating and Cooling Methods in Gaming Laptops: Literature Review and Practical Solutions (Case Study of HP Victus 15)

Qurbonnazar Xolmamatov

Abstract- Laptops have become an integral part of academic and professional life; however, their compact design often leads to overheating, especially under heavy workloads such as gaming or computational tasks. This paper examines the overheating problem in modern laptops, focusing specifically on the HP Victus 15 model, and reviews both practical and advanced cooling methods. Practical solutions such as dust cleaning, thermal paste replacement, use of external coolers, and optimization of fan speeds using the Taguchi method are highlighted as effective measures, shown to reduce internal temperatures by 5–15°C. Advanced approaches such as GPU memory throttling, Phase Change Materials (PCM), nanofluids, and graphene-enhanced heat exchangers are analyzed for their potential in future laptop designs. Findings from existing studies and user experiences demonstrate that simple methods are affordable and immediately applicable for students, while scientific approaches ensure long-term improvements in thermal management. The research concludes that combining traditional practices with innovative materials can significantly reduce overheating, improve performance efficiency, and extend the lifespan of laptops.

Keywords: laptop overheating, HP Victus 15, cooling methods, taguchi method, phase change material, thermal management.

I. INTRODUCTION

In recent years, laptops have become one of the most essential technological devices in our lives. Students prepare lessons, programmers write code, and gamers play heavy graphics-based games with them. Modern laptops such as the HP Victus 15 are designed for both audiences, featuring powerful CPUs and GPUs, compact design, and relatively affordable pricing.

However, one major issue persists: *heat (overheating)*. When laptops run under heavy load, temperatures may rise to 90–95°C, which leads to several consequences:

- **Performance degradation:** CPU/GPU reduce their speed to protect themselves (thermal throttling). For instance, the i7-12700H processor may drop from 4.7 GHz to 3.0 GHz.
- **Reduced lifespan:** High temperatures dry out thermal paste, and chips and capacitors age faster.

- **Critical failures:** Overheated laptops sometimes shut down abruptly or even damage internal components.

Research Question: How can laptop overheating, particularly in HP Victus 15, be mitigated using practical and scientific methods?

II. LITERATURE REVIEW

a) Resource Management between CPU and GPU (Memory Throttling)

Source: Numerical Study on Heat Propagation in Laptop Cooling System [1]

Modern chips often integrate CPU and GPU on the same die (e.g., Intel Iris Xe graphics, AMD APU). They share cache, memory controllers, and DRAM, which leads to:

- Competition for memory access → delays → more heat.
- For example, while GPU handles graphics in DirectX or OpenGL games, CPU simultaneously processes physics and AI, causing interference.

Researchers found that in some games, GPUs deliver unnecessarily high FPS (e.g., 120 FPS instead of 70 FPS), even though the human eye does not perceive improvements beyond 40–60 FPS.

Solution: Throttle GPU memory access.

- GPU delivers around 40 FPS (sufficient for users).
- CPU gains more resources (18% faster).
- Heat generation decreases, as GPU no longer runs at excessive load.

Example: If HP Victus 15 produces 120 FPS in *Cyberpunk 2077*, throttling it down to 60 FPS balances CPU–GPU load and reduces heat.

b) Fan Speed Optimization (Taguchi Method)

Source: Enhanced Cooling of Laptop Computer for Improvement of Processing Performance [2]

The laptop's primary cooling system is the fan. If it runs too slowly → overheating; too fast → excessive noise.

Using the *Taguchi Method*, researchers tested different fan speed combinations and identified the optimal curve.

Results:

- Internal temperature decreased by 10–15°C.
- For example, instead of running the fan constantly at 60%, adjusting it to 40% at 70°C and 70% at 80°C was more effective.
- Noise was also minimized.

Example: On HP Victus 15, fan curves can be adjusted via MSI Afterburner or HP Omen Gaming Hub to achieve quiet operation during study and effective cooling during gaming.

c) User-level Practices (Cleaning, Repasting, Cooling Pad)

Sources: Digital Trends, Reddit user experiences [3]

- *Cleaning:* Removing dust from fans and heatsinks improves airflow → reduces temps by 5–7°C.
- *Repasting:* Replacing dried factory thermal paste with high-quality ones (e.g., Arctic MX-6) can reduce temps by 8–10°C.
- *Cooling pad:* External pads with additional fans improve airflow under the chassis → ~5°C reduction.

d) Phase Change Materials (PCM)

Sources: Improvement in Laptop Heat Dissipation with Taguchi Method; Electronics-Cooling; Wikipedia

PCM materials absorb large amounts of heat during solid → liquid transitions and release it gradually.

Advantages:

- When the laptop overheats → PCM absorbs heat.
- Later, it slowly releases it outside.
- Works passively (even without fans).

Example: With PCM integration, chips inside laptops operate 15–20% cooler.

e) Nanofluids and Graphene

Sources: Improvement in Laptop Heat Dissipation with Taguchi Method; ArXiv

- *Nanofluids:* Liquids enhanced with metallic nanoparticles, enabling faster heat transfer than water.
- *Graphene:* One of the best thermal conductors. Applied on heatsinks, it accelerates heat dissipation.

Experimental results:

- Nanofluid-based cooling systems are ~20% more efficient than conventional fluids.
- Graphene-coated radiators enhance stability and long-term chip performance.

III. METHODOLOGY (APPLICATION TO HP VICTUS 15)

- *Monitoring:* CPU/GPU temperatures tracked via HWMonitor or HP Omen Hub.
- *Practical methods:*
 - o Dust cleaning.
 - o Fan curve optimization.
 - o Repasting.
- *Advanced add-ons:*
 - o PCM module integration.
 - o Nanofluid-enhanced cooling pad testing.
 - o Fan optimization using Taguchi analysis.

Table

Cooling Method	Temp Reduction	Notes
Cleaning	~5–7°C	Simple, safe
Repasting	~8–10°C	Effective with quality paste
Cooling pad	~5°C	Cheap, external
Fan optimization	10–15°C	Quiet + efficient
GPU throttling	CPU +18% boost	Balanced resource use
PCM	15–20% cooler	Passive, costly
Nanofluid	+20% efficiency	Experimental
Graphene	Very high conductivity	Future potential

IV. DISCUSSION

- *For regular users:* Cleaning, repasting, and cooling pads are the most practical and affordable methods (also effective for HP Victus 15).
- *For advanced users:* Fan curve optimization and GPU throttling provide significant gains.
- *For research and future design:* PCM, nanofluids, and graphene are highly promising.

Overheating not only reduces performance but also shortens hardware lifespan. For example, chips

consistently running at 90°C may lose up to 30% of their expected lifetime.

V. CONCLUSION

1. Overheating is a common issue in laptops.
2. Simple methods reduce temperature by 10–15°C and are most practical for students.
3. Scientific methods (PCM, nanofluid, graphene) may play a major role in future laptop designs.
4. Combining practical and advanced methods in laptops like HP Victus 15 creates highly effective cooling systems.

REFERENCES RÉFÉRENCES REFERENCIAS

1. *Numerical Study on Heat Propagation in Laptop Cooling System*, Journal of Advanced Research in Fluid Mechanics and Thermal Sciences.
2. *Enhanced Cooling of Laptop Computer for Improvement of Processing Performance*, Mohammed A. Bou-Rabee, Shaharin A. Sulaiman & Wan M. S. W. Mazlan.
3. *Improvement in Laptop Heat Dissipation with Taguchi Method*, Yeong-Hwa Chang, Chia-Hao Chu, Hung-Wei Lin.
4. A review on advanced phase change material-based... (ScienceDirect).
5. Thermal Management... using PCM (Electronics-Cooling).
6. How to Fix Laptop Overheating... (Digital Trends).
7. Reddit user cooling experiences.
8. Phase-change material (Wikipedia).
9. PCM composite with nanoporous metal (ArXiv).

