Lady Linux – Focus Area Module

Hardware Platform Exploration & Repairability

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1. Focus Area Overview

Purpose:
The Hardware Platform Exploration role examines the physical computing environments on which Lady Linux can realistically operate. This includes evaluating desktop, laptop, and experimental hardware platforms for compatibility, performance, repairability, and long-term sustainability.

Context Within the System:
While software defines Lady Linux's capabilities, hardware determines its limits. This role informs operating system design, LLM deployment decisions, and user expectations by identifying what hardware configurations are feasible, ethical, and aligned with the project's human-centered goals.

Relevance:
Modern consumer hardware is increasingly locked down, difficult to repair, and designed for short lifespans. This role exposes students to the intersection of hardware design, business incentives, sustainability, and user autonomy—critical considerations in responsible computing.

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2. Learning Objectives & Goal Setting

Initial Goals:

1. Identify hardware platforms suitable for running Lady Linux.
2. Evaluate hardware constraints affecting OS and LLM performance.
3. Assess repairability and upgrade potential of selected devices.
4. Document trade-offs between performance, openness, and sustainability.
5. Provide hardware recommendations to inform system design.

Required Skills & Knowledge:

- Basic computer hardware architecture
- Linux hardware compatibility concepts
- CPU, GPU, memory, and storage fundamentals
- Power, thermal, and performance considerations
- Technical documentation and research literacy

Success Criteria:

- Clear evaluation of multiple hardware platforms
- Evidence-based conclusions
- Practical recommendations usable by other teams
- Accurate terminology and technical clarity

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3. Research & Planning Phase

Background Research:

- Desktop and laptop hardware architectures
- CPU vs GPU workloads for LLM inference
- Linux hardware compatibility lists
- Repairability standards and right-to-repair initiatives
- Case studies of modular or repairable devices

Design Constraints:

- Budget and hardware availability
- Power consumption and thermal limits
- Driver and firmware support
- Proprietary vs open hardware components
- Physical durability and lifespan

Proposed Approach:
Select several representative hardware platforms (e.g., desktop PC, older laptop, single-board computer) and analyze their suitability for Lady Linux using documentation, benchmarks, and limited hands-on testing where possible.

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4. Workflow & Implementation

Development Workflow:

1. Identify candidate hardware platforms
2. Gather technical specifications and documentation
3. Assess Linux compatibility and driver support
4. Evaluate performance for system and LLM workloads
5. Examine repairability and upgrade paths

6. Document findings and recommendations

Tools & Technologies:

- System inspection tools (e.g., `lscpu`, `lsblk`, `lspci`)
- Benchmarking utilities
- Hardware documentation and teardown guides
- Virtual machines or test installations

Integration Points:

- OS configuration requirements
- LLM resource needs
- Security and firmware constraints
- Mobile vs desktop adaptation considerations

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5. Deliverables

Primary Deliverables:

- Hardware evaluation report
- Comparison table of tested platforms
- Repairability and sustainability assessment
- Recommended hardware profiles for Lady Linux

Supporting Artifacts:

- Photos or diagrams (if hardware is examined)
- Benchmark results
- Compatibility notes and troubleshooting logs

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6. Validation & Evaluation

Testing & Verification:

- Confirm hardware specifications via system tools
- Validate Linux compatibility through installation or live testing
- Compare performance against documented expectations

Limitations Identified:

- Limited access to certain hardware types
- Incomplete vendor documentation
- Inability to modify proprietary firmware

Risk Assessment:

- Overestimating hardware capability
- Ignoring thermal or power constraints
- Assuming repairability without verification

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7. Reflection & Critical Analysis

Learning Reflection:
Students reflect on how hardware design influences software freedom, system longevity, and user control. Emphasis is placed on understanding trade-offs between convenience, performance, and sustainability.

Challenges & Resolutions:
Challenges may include hardware failure, driver issues, or limited documentation. Students document how these challenges were addressed or mitigated.

Impact on the Overall System:
This role shapes realistic expectations for Lady Linux deployment and informs design decisions across OS, LLM, and UI teams.

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8. Future Work & Recommendations

Improvements:

- Explore modular or repair-first hardware designs
- Investigate low-power or edge-computing platforms
- Propose standardized hardware profiles for future cohorts

Long-Term Relevance:
Hardware findings support long-term sustainability and scalability of Lady Linux as an open-source project.

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9. Documentation & Presentation

Documentation Standards:
Reports must be clear, reproducible, and accessible to non-hardware specialists.

Presentation Component:
The student presents hardware findings, emphasizing how physical constraints shape system design and user experience.

Assessment Alignment (Faculty Use)

- Depth of hardware analysis
- Accuracy of technical evaluation
- Practical relevance of recommendations
- Consideration of sustainability and repairability
- Quality of reflection and documentation