

RigSense Engine

An Intelligent AI-Driven PC Building and Optimization Platform

1. Introduction

RigSense Engine is an intelligent, interactive, and user-centric PC-building assistant designed to simplify and optimize the process of configuring custom desktop computers. Building a PC is often complex due to component incompatibility, budget misallocation, and lack of clarity around performance metrics. Existing platforms either cater to experts or focus on selling hardware rather than helping users make informed decisions.

RigSense Engine addresses these issues by combining **rule-based compatibility validation**, **AI-assisted optimization**, and a **guided, beginner-friendly interface**. The platform supports users ranging from first-time PC builders to advanced enthusiasts, ensuring transparency, correctness, and performance efficiency.

2. Problem Statement

Users attempting to build a PC face several challenges: - Difficulty understanding technical specifications - High risk of incompatible component selection - Poor budget distribution across components - Lack of clear performance expectations - Overwhelming interfaces in existing tools

RigSense Engine aims to solve these problems by providing a **decision-support system** rather than a simple component selector.

3. Objectives

- Simplify PC building for beginners
 - Ensure 100% component compatibility
 - Optimize performance within a given budget
 - Provide transparent explanations for recommendations
 - Offer upgrade and alternative build suggestions
 - Deliver a visually engaging and smooth user experience
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4. Target Users

- Students and first-time PC builders
- Gamers (1080p / 1440p / 4K)

- Content creators and editors
 - Budget-conscious users
 - PC enthusiasts seeking optimized builds
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5. Key Features of RigSense Engine

5.1 Guided Build Wizard

Users begin by answering a short questionnaire: - Total budget - Primary use case (Gaming, Editing, Streaming, Workstation, General) - Performance preference (Balanced / Performance-focused) - Upgrade priority

Based on these inputs, the system generates optimized build suggestions.

5.2 Preset Build Categories

The system automatically generates three build tiers: - **Budget Build** – Cost-efficient and upgrade-friendly - **Mid-Range Build** – Balanced performance and longevity - **High-Performance Build** – Maximum performance within budget

Users may select a preset, customize it, or build entirely from scratch.

5.3 Dynamic Component Recommendation System

As users select or modify components, RigSense Engine: - Suggests only compatible components - Displays recommendations in three tiers: Budget, Mid, Premium - Ranks options using AI-based scoring

5.4 Real-Time Compatibility Verification (Core Feature)

RigSense Engine uses a **rule-based compatibility engine** to ensure correctness: - CPU ↔ Motherboard socket compatibility - RAM type and motherboard support (DDR4 / DDR5) - PSU wattage vs estimated system power draw - GPU slot compatibility

Compatibility errors are explained clearly with corrective suggestions.

5.5 Live Budget Tracking and Optimization

- Real-time budget consumption display
- Remaining budget indicator
- Smart budget rebalance suggestions
- Warnings for over-spending on low-impact components

5.6 AI-Driven Performance Optimization

Artificial Intelligence is used for **ranking and optimization**, not for critical validation: - Performance-to-price scoring - Component ranking based on use case - Build optimization within budget constraints

This approach ensures explainability and reliability.

5.7 Performance Insights & Analytics

The platform provides: - Relative benchmark scores - Performance tier classification - Power consumption estimates - Value-for-money score

These insights help users understand trade-offs clearly.

5.8 Bottleneck Awareness System

RigSense Engine identifies potential imbalances: - CPU-GPU mismatch warnings - Overkill component detection

This prevents inefficient builds and wasted budget.

5.9 Beginner & Expert Mode

- **Beginner Mode:** Simplified UI, guided recommendations, minimal technical jargon
- **Expert Mode:** Full manual control, advanced metrics, detailed specifications

Users can switch modes seamlessly.

5.10 Build Confidence Score

Each completed build receives a confidence score based on: - Compatibility - Budget balance - Performance alignment - Upgrade potential

This increases user trust and decision confidence.

5.11 Alternative Build Suggestions

Upon build completion, the system suggests: - A lower-cost optimized alternative - A higher-performance alternative

This enables informed comparison.

5.12 Upgrade Path Planning

RigSense Engine recommends: - Future upgrade priorities - Expected performance gains - Upgrade timing suggestions

5.13 Build Report Generation

The final build report includes: - Component list with prices - Compatibility confirmation - Performance and power estimates - Budget breakdown - Upgrade recommendations

Reports can be viewed on-screen or exported.

5.14 Interactive & Animated UI

- Smooth transitions and micro-animations
- Animated budget bars and alerts
- Optional 3D PC visualization on landing page

Animations enhance usability without affecting performance.

6. Comparison with Existing Platforms

Feature	Existing PC Builders	RigSense Engine
Beginner Guidance	Limited	Yes
AI Optimization	No	Yes
Real-Time Compatibility	Partial	Full
Budget Optimization	Minimal	Advanced
Performance Explanation	No	Yes
Upgrade Planning	No	Yes
Transparency	Medium	High

RigSense Engine combines the strengths of existing tools while eliminating their weaknesses.

7. System Architecture

Frontend

- React.js
- Tailwind CSS
- Framer Motion

Backend

- Node.js
- Express.js
- RESTful APIs

AI / ML Layer

- Python
- Flask
- Scikit-learn

Database

- MongoDB

Deployment

- Frontend: Vercel
 - Backend & ML API: Render
 - Database: MongoDB Atlas
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8. Technology Stack Justification

- **React + Tailwind:** Fast, scalable, and modern UI development
 - **Node.js:** Efficient API handling and rule-based logic
 - **Python ML:** Clean separation of optimization logic
 - **Rule-based compatibility:** Accuracy and determinism
 - **AI optimization:** Intelligent ranking and recommendations
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9. Scope of Implementation

Implemented Features

- Guided build flow
- Compatibility engine
- Budget tracking

- AI-based ranking
- Alternative builds
- Upgrade recommendations

Future Enhancements

- Real-time pricing integration
 - FPS prediction
 - Store linking and availability
 - User accounts and saved builds
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10. Conclusion

RigSense Engine is not just a PC builder, but an **intelligent decision-support platform**. By integrating AI-assisted optimization, strict compatibility validation, dynamic budgeting, and a user-friendly interface, the system significantly reduces the complexity of custom PC building. The platform empowers users to make informed, efficient, and confident decisions while learning about PC hardware in the process.

11. References (Conceptual)

- Public benchmark datasets
- PC hardware specification documentation
- Industry-standard compatibility rules