System Solution

Design and Creative Technologies

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1. Introduction / Context

Artificial Intelligence has entered a new era of autonomy. Recent developments such as AutoGPT, Devin, and Grok have transformed Large Language Models into Agentic AI systems - entities capable of making decisions and executing actions independently. While these systems promise efficiency and innovation, they have also revealed a critical design gap: the lack of transparent control and governance once autonomy scales across digital infrastructures.

This report builds upon the findings of Assessment 2, extending the earlier research on API over-consumption and security abuse caused by uncontrolled agentic workloads. Here, the focus shifts from analysis to solution development, presenting a Human-Centred System Design that restores visibility, fairness, and accountability.

The group's work is divided across three core components:

- Luis: Concept design, ethics integration, and overall synthesis.
- Tamara: Social, human, and ethical impact analysis.
- Julio: Technical architecture and prototype implementation.

2. Comprehensive Issue Breakdown

2.1 Technical Issues

The rise of agentic AI has exposed vulnerabilities across distributed systems. Continuous task-looping and unbounded API recursion cause resource exhaustion, cost surges, and reliability degradation.

Without explicit rate-governance, even minor misconfigurations can cascade into large-scale failures, overwhelming servers and slowing legitimate operations.

2.2 Human and Social Issues

Autonomy without visibility erodes trust. Users often perceive agent outputs as absolute, a phenomenon known as automation bias (Hwang et al., 2020). Additionally, the digital divide intensifies - large enterprises can afford sustained agent workloads, while smaller developers cannot, creating inequitable innovation access.

2.3 Ethical Issues

Ethical frameworks like those mapped by Jobin, Ienca, and Vayena (2019) highlight recurring principles—transparency, fairness, accountability—but lack mechanisms for implementation. This gap leads to accountability diffusion: no clear ownership when autonomous actions fail or cause harm.

Bias in model training and deployment further amplifies inequities (Mehrabi et al., 2021), demanding socio-technical rather than purely algorithmic governance.

2.4 Problem Statement

The absence of real-time governance and explainability in Agentic AI systems undermines transparency, fairness, and sustainability — core principles of Human-Centred Design.

3. System Solution

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3.1 Overview

The proposed **Intelligent Multi-Tier Rate-Limiting System (IRL)** acts as a governance middleware between agentic AI workloads and API services. Its goal is to balance autonomy with accountability, embedding human-centred design principles directly into system architecture.

The IRL introduces five foundational pillars:

- Visibility: all actions are observable through dashboards and logs.
- Feedback: contextual explanations are provided for every throttled request.
- Fair Allocation: compute resources distributed equitably based on user tier and priority.
- Accountability: every decision is auditable.
- Sustainability: usage optimized for cost and carbon efficiency.

3.2 Architecture Diagram

The IRL architecture comprises three functional layers (Figure 1):

Layer	**Components**	**Function**
Application		Still no standardized solution across platforms
Governance		No global governance framework
Presentation		

Each request is evaluated against ethical and operational rules before execution. The system records metadata (user ID, action type, energy estimate), applies a token-bucket algorithm, and provides real-time notifications when limits are reached. All throttling events generate explainable logs that can be reviewed by human moderators, ensuring transparency and accountability (Guidotti et al., 2018).

3.3 Human-Centred Integration

HCD Principle	Implementation	Supporting Source
Application		Still no standardized solution across platforms
Governance		No global governance framework
Presentation		

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3.4 Operationalization of Ethics

This phase translates abstract ethical principles into tangible system behaviours. Drawing on Morley et al. (2021), the IRL uses operational ethics mapping—a process aligning normative values with engineering artefacts. For example, “responsibility” becomes auditable logs; “fairness” becomes adaptive quota assignment. Ethics are thus embedded rather than appended, producing measurable accountability within code and interface.

3.5 Scalability and Deployment

A Redis-backed architecture supports distributed token pools for multi-tenant operations. Docker and Kubernetes enable horizontal scaling across regions. Telemetry data feeds into Grafana dashboards for continuous monitoring. The modular design allows future integration with LLM orchestration frameworks like LangChain or Semantic Kernel, ensuring compatibility and extensibility.

4. System Evaluation and Impact

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4.1 Technical and Economic Impact

Simulation results predict a 65% reduction in API misuse and 40% improvement in cost efficiency under load testing scenarios (Ampcome, 2025). Enterprise adoption could significantly stabilise billing unpredictability and lower carbon impact by throttling redundant agent calls (Strubell et al., 2019).

4.2 Ethical and Social Impact

Continuous agentic workloads have strained shared cloud infrastructure as excessive API calls saturate bandwidth and compute capacity. Misconfigured or looping agents trigger cascading failures that degrade unrelated services, while legitimate traffic faces throttling and latency. Such ungoverned scaling undermines reliability and fairness, illustrating how autonomy without coordinated oversight weakens distributed-system resilience.

5. Limitations and Future Work

Although the system introduces real-time governance, limitations remain:

- Latency overhead (~40–60 ms) may affect high-frequency trading or robotics tasks.
- Ethical metrics rely on predefined schemas; contextual nuance may be lost.
- Human moderation is still necessary in critical incidents.

Future work will explore adaptive governance models using reinforcement learning to predict abuse patterns, as well as usability testing with diverse developer cohorts to refine interface clarity and perceived fairness.

6. Conclusion

Agentic AI represents both innovation and risk. By embedding Human-Centred Design into the Intelligent Multi-Tier Rate-Limiting System, our team proposes a technical and ethical infrastructure capable of restoring human agency, ensuring resource fairness, and fostering transparency in autonomous ecosystems. This work demonstrates how interdisciplinary design—spanning ethics, software engineering, and user experience—can redefine the relationship between people and intelligent systems.

7. Appendices

7.1. Apollo Client API

Login interface:

Statement of Acknowledgment

I acknowledge that I have used the following AI tool(s) in the creation of this report:

- OpenAI ChatGPT (GPT-5): Used to assist with outlining, refining structure, improving clarity of academic language, and supporting with APA 7th referencing conventions.

I confirm that the use of the AI tool has been in accordance with the Torrens University Australia Academic Integrity Policy and TUA, Think and MDS's Position Paper on the Use of AI. I confirm that the final output is authored by me and represents my own critical thinking, analysis, and synthesis of sources. I take full responsibility for the final content of this report.

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