

**Week 1: Team Project**

**“High End Refrigerator”**

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**National University**

**CSC300 Object Oriented Design**

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**Assignment Due Date: 02 Nov 25**

### Section 3: System Constraints and Technical Limitations

ID	CONSTRAINT	DESCRIPTION/JUSTIFICATION
C1	Touchscreen display panel shall be a 10-inch 1080p capacitive screen with corning-glass protection and proximity wake-up sensor.	Ensures visibility, durability, and seamless activation per R1–R3.
C2	System must operate within ambient temperatures of 35°F–110°F and relative humidity ≤85%.	Supports both kitchen and garage environments while protecting electronic components.
C3	Total smart module power consumption (display, processor, sensors, Wi-Fi, camera) ≤150W.	Maintains Energy Star efficiency while supporting new visual and recognition features (ENERGY STAR, n.d.).
C4	Processor thermal design power (TDP) ≤15W using passive cooling only.	Prevents heat buildup in food storage zones and ensures silent operation.
C5	Camera module shall capture at least 720p resolution images under LED illumination and comply with GS1 EAN/UPC barcode standards.	Supports barcode and object recognition accuracy for inventory tracking (GS1, n.d.).
C6	Local storage must support ≥1,000 item records including image metadata and expiration data.	Accommodates manual and automated entries from R8–R9 without cloud reliance.
C7	System reboot after power loss ≤30 seconds with data persistence from non-volatile storage.	Ensures continuous operation and prevents data loss from outages.
C8	Embedded operating system shall use Linux (Yocto-based) with secure HTTPS firmware updates per NIST IoT baseline recommendations.	Provides stability, scalability, and cybersecurity for Wi-Fi (NIST, 2020).
C9	Connectivity limited to Wi-Fi 802.11ac, no cellular integration in MVP.	Simplifies firmware scope and eliminates additional regulatory constraints.

C10	Voice recognition limited to English (single-language model).	Aligns with MVP scope and simplifies training for voice command features.
C11	Temperature sensors shall provide readings with $\pm 1^{\circ}\text{F}$ accuracy and update rate $\leq 1$ second, maintaining fridge $\leq 40^{\circ}\text{F}$ and freezer $0^{\circ}\text{F}$ .	Complies with FDA food safety standards for cold storage (FDA, 2024).
C12	Humidity control mechanism shall adjust within $\pm 5\%$ of target setting.	Meets R5 requirements while minimizing compressor cycling for efficiency.
C13	Network operations shall use WPA3 encryption and restrict external access to authorized mobile devices.	Protects user data such as email/phone info stored under R12 (Wi-Fi Alliance, n.d.).

### Analyst Summary

These constraints establish the hardware, environmental, and data-processing boundaries that govern the refrigerator's MVP. They ensure reliability, safety, and feasibility while supporting expanded features such as barcode scanning, recipe generation, and voice control. Following Kung's (2013) object-oriented design principles and industry standards (FDA, 2024; ENERGY STAR, n.d.; NIST, 2020), these limitations reflect the necessary balance between performance, cost, and quality, enabling iterative Agile development while maintaining system integrity and user trust.

### References:

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