

# Fridgemate

# LUXE



Group 4 -  
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# Agenda

**Preserve Perfectly, Consume Wisely:**  
Elevate your fridge with FridgeMate Luxe



Problem Statement

Solution/Vision

Business Model Canvas

Market Specification

Product Specification

DFMEA

Stakeholder Matrix

Way Ahead

# Problem

## Inefficient Temperature Management

A single temperature setting for the entire unit, which is not optimal for different types of food products, leading to premature spoilage and waste

## Wastage & Economic Loss

The inability to monitor and adjust conditions for stored items contributes to unnecessary waste and economic loss for consumers.

## Lack of Visibility

Difficulty in tracking the quantity and expiration dates of items stored, resulting in overlooked items that eventually go bad.

## Energy Efficiency

Most of the refrigerators consume a lot of energy leading to an increased electricity rates & consumption of fossil fuels.



# Solution

## Individual Compartment Temperature Control

Each compartment within the refrigerator can be regulated to its specific optimal temperature for the type of food it stores, extending the freshness and lifespan of diverse products.



## Intelligent Inventory Management

The refrigerator tracks the stock levels and conditions of all items, offering suggestions for replenishment and alerting users to products that need immediate attention, reducing waste and saving money.

## Advanced Display System

An integrated display provides real-time information on the temperature settings, quantity of each item, and the health status of products. It alerts users to items nearing their expiry date, making it easier to consume or replace them before spoilage.

## Advanced Thermoelectric Cooling

Utilizing advanced thermoelectric cooling technology, it minimizes energy consumption while maximizing freshness.



# Business Model Canvas

Designed for: FridgeMate Luxe

Designed by: FreshFusion Crew

Date: 02/23/2024 Version: 1.0

<b>Key Partners</b> Technology providers for smart features & components. Service & repair companies' maintenance & other services. Distribution partners for retail and online sales. Smart Home ecosystem partners for integration. Marketing agencies for advertising and promotion	<b>Key Activities</b> Continuous product development and innovation. Marketing and sales campaigns. Customer service and support. Supply chain and inventory management.	<b>Value Propositions</b> Enhanced food preservation through individual compartment temperature control Reduction in food wastage with expiration tracking and alert system. Energy efficiency with smart cooling technology. Improved user experience with intuitive inventory management and display.	<b>Customer Relationships</b> Personalized online support and customer service. Engaging social media presence for brand building and support. Warranty and post-purchase services to ensure customer satisfaction.	<b>Customer Segments</b> <ul style="list-style-type: none"><li>Environmentally conscious households looking for energy-efficient appliances.</li><li>Tech-savvy consumers seeking smart home integration.</li><li>Busy families and individuals needing efficient food management solutions.</li><li>High-income households desiring premium kitchen appliances.</li></ul>
<b>Cost Structure</b> R&D for product development. Manufacturing and production costs. Marketing and sales expenses. Distribution and logistics expenses. Operational and administrative expenses.	<b>Revenue Streams</b> Sales of "FridgeMate Luxe" units. Extended warranties and service packages. Potential subscription services for premium inventory management features. Sales of just display modules for existing.			

# Market Specification

User Requirement	Definition	Rationale	Performance	Source
Individual item life cycle display	This user requirement entails a feature within the Smart Refrigerator's interface that visually presents the life cycle stages of each food item stored in the refrigerator. The display should include information such as the date of purchase, expiration date, remaining shelf life, and any relevant storage recommendations (e.g., temperature, humidity).	By automatically tracking stock levels and monitoring the condition of stored items, the Smart Refrigerator helps users stay organized and avoid food wastage. It addresses the need for efficient inventory management and promotes sustainability by minimizing unnecessary purchases and reducing food waste.	<b>Target:</b> An advanced inventory management system that automatically tracks stock levels, monitors product conditions, and provides real-time updates to users. <b>Minimum:</b> Provide basic inventory tracking functionality that allows users to manually input and update the quantities of stored items.	Consumer Forums and reviews
Customizable storage options	Users may want the ability to customize the interior layout of the refrigerator to accommodate different sizes and shapes of food items, including adjustable shelves, dividers, and storage bins	Providing users with customizable storage options ensures that they can adapt the refrigerator's interior layout to suit their specific storage needs and preferences, enhancing user convenience and maximizing storage efficiency.	<b>Target:</b> Provide fully adjustable shelves and compartments that can be reconfigured to accommodate items of various sizes and shapes. <b>Minimum:</b> Offer removable shelves with adjustable height settings to allow users to create space for taller items.	Trade shows and exhibitions, Market Research

User Requirement	Definition	Rationale	Performance	Source
Inner layer insulation	This user requirement specifies that the Smart Refrigerator should be equipped with advanced insulation materials and design features in its inner layers to optimize temperature retention and energy efficiency.	Inner layer insulation helps prevent rapid temperature fluctuations caused by external factors such as ambient temperature changes or frequent door openings, ensuring that stored items remain fresh and safe for consumption.	<p><b>Target:</b> Ensure uniform insulation coverage throughout the refrigerator cabinet, including the walls, doors, and compartments.</p> <p><b>Minimum:</b> Provide an insulation thickness that meets or exceeds industry standards for residential refrigerators, typically ranging from 1 to 2 inches.</p>	Industry publication reviews
No excessive ice build age.	The refrigerator should employ advanced defrosting technologies, such as frost-free or auto-defrost systems, which periodically melt accumulated ice and drain the resulting water away.	Excessive ice buildup in the freezer compartment can occupy valuable storage space, reducing the available room for storing food items. By preventing excessive ice buildup, the Smart Refrigerator maximizes storage capacity.	<p><b>Target:</b> Optimize the refrigerator's air circulation system to minimize humidity levels and prevent condensation, which can contribute to ice buildup.</p> <p><b>Minimum:</b> Ensure that the refrigerator is equipped with an adequate drainage system to remove melted ice and prevent water accumulation within the appliance</p>	Consumer reviews, Market research
Odor Foulness Management	Integration of active odor control systems, such as activated carbon filters or ionizers, that work to neutralize and eliminate foul odors circulating within the refrigerator compartments.	Foul odors in the refrigerator can create an unpleasant environment for users when accessing and using the appliance. Managing odor foulness improves the user experience by maintaining a clean and fresh-smelling refrigerator, enhancing user satisfaction and convenience.	<p><b>Target:</b> Design the refrigerator's airflow system to ensure proper circulation and ventilation, which helps prevent stagnant air pockets where odors can accumulate.</p> <p><b>Minimum:</b> Enhance the refrigerator's door seals and gaskets to ensure a tight and secure closure, minimizing the infiltration of external odors into the refrigerator compartments.</p>	Market research reports, social media survey.

User Requirement	Definition	Rationale	Performance	Source
Water Leakage prevention	<p>This user requirement specifies that the Smart Refrigerator should incorporate features and safeguards to prevent water leakage from occurring, which can result from various sources such as malfunctioning water supply lines, clogged drain tubes, or condensation buildup.</p>	<p>Moisture from water leakage can create an ideal environment for mold and mildew growth, both inside the refrigerator and in surrounding areas. By preventing water leakage, the Smart Refrigerator helps maintain a dry and hygienic environment, reducing the risk of mold and mildew contamination.</p>	<p><b>Target:</b> Integrate an automatic shut-off valve into the water supply line connected to features like ice makers or water dispensers, which can automatically stop the flow of water in the event of a detected leak. <b>Minimum:</b> Ensure that all water supply lines and connections are securely fastened and properly sealed to prevent leaks from occurring due to loose or faulty connections.</p>	Industry publication reviews
Magnetic Door Seal	<p>This user requirement specifies that the Smart Refrigerator should feature a magnetic door seal mechanism to ensure a tight and secure closure of the refrigerator and freezer compartments.</p>	<p>Excessive ice buildup in the freezer compartment can occupy valuable storage space, reducing the available room for storing food items. By preventing excessive ice buildup, the Smart Refrigerator maximizes storage capacity.</p>	<p><b>Target:</b> Ensure that the magnetic door seal generates a strong and reliable magnetic force to create a tight and secure closure of the refrigerator doors. <b>Minimum:</b> Ensure that the magnetic door seal applies sufficient pressure to form a tight seal when the refrigerator doors are closed.</p>	Retailer websites, market research
Data Privacy and security	<p>The Smart Refrigerator collects and processes data about users' food inventory and consumption habits. If the device's security measures are insufficient, it could be vulnerable to hacking or unauthorized access, compromising users' privacy and sensitive information.</p>	<p>Providing assurances of data privacy and security builds trust and confidence among users, encouraging greater adoption and usage of the Smart Refrigerator. Users are more likely to engage with the appliance and share their data if they feel confident that it is protected from unauthorized access or misuse.</p>	<p><b>Target:</b> Implement end-to-end encryption for all data transmitted between the Smart Refrigerator and external servers or devices, ensuring that sensitive information remains secure and private. <b>Minimum:</b> Use secure communication protocols, such as HTTPS or SSL/TLS, to encrypt data during transmission between the Smart Refrigerator and external servers or devices.</p>	Trade association and Organization research.

User Requirement	Definition	Rationale	Performance	Source
Multi language support	Support for multiple languages in the user interface caters to diverse user demographics, enhancing accessibility and usability for non-native language speakers.	Providing content and interfaces in multiple languages improves the user experience by allowing users to interact with the Smart Refrigerator in their preferred language. This reduces language barriers and ensures that users can fully understand and utilize the appliance's features, leading to greater satisfaction and engagement.	<b>Target:</b> Implement a user interface that supports seamless switching between multiple languages, allowing users to select their preferred language for operating the Smart Refrigerator. <b>Minimum:</b> Provide a basic language selection option in the refrigerator's interface, allowing users to choose from a predefined list of supported languages.	Industry publication reviews
Packaging	The packaging should use high-quality and durable materials to protect the refrigerator during transportation and handling, ensuring it arrives at the user's location in pristine condition.	The Echo Chill refrigerator is a valuable investment for users, and ensuring its safe arrival without damage is crucial to maintain customer satisfaction. High-quality packaging materials protect the refrigerator from impacts, vibrations, and other hazards during transportation.	<b>Target:</b> The packaging should provide additional protection against rough handling or accidents during transit, reducing the likelihood of damage to delicate components or surfaces. <b>Minimum:</b> The packaging should protect the refrigerator from minor bumps and jolts during transit, minimizing the risk of cosmetic damage or functional issues.	Consumer forums, market research.
Labelling	The labeling should clearly identify the product as the Echo Chill refrigerator, including the brand name, model number, and any relevant product variants or specifications.	Clear product identification ensures that users can easily recognize the Echo Chill refrigerator among other products. By prominently displaying the brand name and model number, users can quickly verify that they have received the correct product they ordered.	<b>Target:</b> Provide comprehensive labeling on the packaging that includes clear product identification, shipping information, barcode/serial number e.t.c. <b>Minimum:</b> Include essential labeling on the packaging that covers basic requirements such as product identification (brand name, model number), shipping information, Safety instructions	Retailers website, consumer reviews.

# Product Specification

	Title	Technical Requirement		Test Method	Source/Rationale	Priority
		Target	Minimum			
Individual item life cycle display	Display Resolution	1080p (1920x1080 pixels)	720p (1280x720 pixels)	Use <b>PassMark Monitor Test</b> which is a standard resolution testing software to verify display resolution	Ensuring high resolution for clear visibility of information; industry standard is <b>480p</b>	High
	User Interface (UI) Responsiveness	Response time of less than 100 ms for any action	Response time of less than 10 ms for any action	Measure response times using UI testing frameworks like <b>Selenium</b> .	Ensures a smooth user experience; aligns with industry standards of <b>200 ms</b>	High
Customizable Storage Options	Adjustable Shelving and Compartments	Shelving and compartments can be adjusted to over 20 different configurations	At least 10 different configurations.	Physical adjustment of shelving and compartments to count the number of possible configurations	Flexibility in storage options is a key demand among consumers for maximizing space and accommodating various food storage needs	Medium
	Material Durability and Safety	Use of BPA-free, antimicrobial materials for all interior surfaces	BPA-free materials	Material testing for compliance with BPA-free and antimicrobial standards using <b>Gas Chromatography with Mass Spectrometric detection (GC/MS)</b> .	Consumer safety and long-term food storage safety are paramount, with increasing awareness of material safety in food contact surfaces.	High

Title	Technical Requirement		Test Method	Source/Rationale	Priority
	Target	Minimum			
Inner Layer Insulation	Thermal Insulation Efficiency	Thermal conductivity not exceeding 0.021 W/(m·K)	Thermal conductivity not exceeding 0.024 W/(m·K)	Conduct thermal conductivity testing using standardized methods such as <b>transient hot wire method (THW)</b> or heat flow meter method	Low thermal conductivity materials are essential for reducing energy consumption and improving cooling efficiency. The industry target is <b>0.021 W/(m·K)</b>
	Fire Resistance	Compliance with UL 94 V-0 flammability standards.	Compliance with a minimum of UL 94 V-2 flammability standards.	Perform flammability testing according to the UL 94 standard procedure like <b>Modified Transient Plane Source (MTPS): (ASTM D7984)</b> or <b>Transient Plane Source (TPS): (ISO 22007-2 and GB/T 32064)</b> .	Ensuring the refrigerator's insulation is resistant to ignition and does not contribute to the spread of fire is crucial for consumer safety. <b>UL 94</b> standards are widely recognized benchmarks for material flammability
Excessive Ice Buildage	Frost Accumulation Rate	Less than 0.5 mm of frost accumulation per week under standard operating conditions	Less than 1 mm of frost accumulation per week	<b>Measure the thickness of frost buildup on the evaporator coils</b> and interior surfaces after operating the refrigerator under standard test conditions for a specified period	Limiting frost buildup enhances cooling efficiency and reduces the frequency of defrost cycles needed, thus saving energy. The target is less than <b>1 mm</b>
	Humidity Control	Maintain internal humidity levels at 60-70% RH (Relative Humidity) to minimize frost formation	50-80% RH	Use hygrometers to monitor humidity levels within the refrigerator during normal operation	Proper humidity management reduces the potential for frost buildup by maintaining optimal moisture levels inside the refrigerator. This specification is based on the optimal humidity range for preserving food freshness while preventing frost

Title	Technical Requirement			Test Method	Source/Rationale	Priority
	Target	Minimum				
Odor Foulness Management	Odor Control Mechanism	Utilization of activated carbon or other odor-absorbing materials in the refrigerator	Presence of activated carbon or equivalent odor-absorbing materials	Odor analysis using sensory evaluation by trained panelists or gas chromatography-mass spectrometry (GC-MS)	Activated carbon effectively absorbs and neutralizes odors, ensuring that stored food remains fresh and free from unpleasant smells	High
	Air Circulation Efficiency	Efficient circulation of air within the refrigerator to prevent stagnant air pockets where odors may accumulate	Uniform distribution of temperature and air flow throughout the refrigerator interior	Thermal imaging or airflow visualization techniques to assess air circulation patterns	Industry standards and best practices recommend the inclusion of leak detection systems to prevent water damage and ensure user safety	High
Water Leakage prevention	Leak Detection System	The leak detection system should accurately detect and alert users of water leakage within 5 minutes	The leak detection system should accurately detect and alert users of water leakage within 10 minutes	<b>Functionality test of the leak detection system under simulated leakage scenarios</b>	Limiting frost buildup enhances cooling efficiency and reduces the frequency of defrost cycles needed, thus saving energy. The target is less than 1 mm	High
	Anti-Leak Seals	Seals and gaskets should maintain a leak-free seal under normal operating conditions for a minimum of 1 year	Seals and gaskets should maintain a leak-free seal under normal operating conditions for 6 months	Visual inspection and pressure testing of seals and gaskets	Properly sealed connections and components are essential for preventing water leakage and maintaining the integrity of the refrigerator's water system	High

Title	Technical Requirement			Test Method	Source/Rationale	Priority
	Target	Minimum				
Magnetic Seal	Magnetic Strength	The magnetic door seal should provide a minimum holding force of 20 Newtons	The magnetic door seal should provide a minimum holding force of 15 Newtons	Measurement of holding force using a force gauge or dynamometer	A strong magnetic seal ensures a tight closure of the refrigerator door, preventing air leaks and maintaining temperature stability	High
	Durability	The magnetic door seal should maintain its effectiveness for a minimum of 5 years	The magnetic door seal should maintain its effectiveness for a minimum of 3 years	Accelerated aging tests and real-world usage monitoring	A durable magnetic seal ensures long-term performance and reliability, reducing the need for frequent replacements	High
Data Security and Privacy	Encryption Standards	Utilization of advanced encryption standards (e.g., AES-256) for securing user data		Verification of encryption algorithms and key management practices	Compliance with industry standards and best practices for data encryption ensures confidentiality and integrity of user data	High
	Secure Authentication	Implementation of secure authentication mechanisms (e.g., password protection, biometric authentication) to control access to sensitive data and features		Testing of authentication protocols and resistance to common attack vectors (e.g., brute force attacks, password guessing)	Secure authentication prevents unauthorized access to user data and ensures only authorized users can interact with the refrigerator	High

Title	Technical Requirement			Test Method	Source/Rationale	Priority
	Target	Minimum				
Multi Language Support	Language Options	The refrigerator's user interface should support a minimum of 5 languages	The refrigerator's user interface should support a minimum of 3 languages	Verification of language options available in the user interface settings)	Supporting multiple languages enhances accessibility and usability for users from different linguistic backgrounds	High
	Language Selection Mechanism	Implementation of an intuitive language selection mechanism that allows users to easily switch between supported languages		Usability testing and user feedback on the effectiveness of the language selection interface	A user-friendly language selection mechanism ensures seamless navigation and enhances user experience for non-native speakers	Medium
Packaging	Protective Packaging Material	The packaging material should withstand drop tests from a height of at least 1 meter without damage	The packaging material should withstand drop tests from a height of at least 0.75 meter without damage	<b>Drop test and compression test to assess material strength and durability</b>	High-quality packaging materials ensure the safe arrival of the refrigerator, minimizing the risk of damage during transit	High
	Easy-to-Open Design	Packaging should allow for opening within 2 minutes by an average user	Packaging should allow for opening within 3 minutes by an average user	User testing and feedback on packaging usability	Easy-to-open packaging enhances user convenience and satisfaction during the unboxing experience	Medium

Title	Technical Requirement			Test Method	Source/Rationale	Priority
	Target	Minimum				
Packaging	Protective Inner Lining	The inner lining material should absorb impact energy equivalent to a drop from a height of at least 0.5 meters	The inner lining material should absorb impact energy equivalent to a drop from a height of at least 0.3 meters	Material integrity testing to assess impact absorption capabilities	Protective inner lining minimizes the risk of damage to the refrigerator's surfaces and components	High
Labelling	Clear Product Identification	font size not less than 10 points	font size not less than 8 points	<b>Visual inspection and readability assessment by users with varying visual abilities</b>	Clear product identification aids users in quickly identifying the refrigerator model and its key features, enhancing user experience	High
	Product Features and Benefits	at least 5 prominent features highlighted	at least 3 prominent features highlighted	User survey on perceived usefulness and relevance of highlighted product features	Highlighting key product features helps users understand the value proposition of the refrigerator and its suitability for their needs	Medium

# DFMEA

Item	Function	Potential Failure	Potential Effect of Failure	SEV	Potential Causes of Failure	OCC	DET	RPN	Recommended Actions
Individual Item Lifecycle Display	Display item lifecycles	Display malfunction	Inaccurate tracking, leading to wastage	6	Software bugs, hardware failure	3	5	90	Regular software updates, use more reliable hardware
Customizable Storage Options	Customize interior layout	Mechanism failure	Inability to adjust storage, reducing efficiency	5	Wear and tear, poor design	2	4	40	Use more durable materials, improve design for adjustability
Inner Layer Insulation	Optimize temperature retention	Insulation degradation	Poor energy efficiency, temperature inconsistency	7	Material degradation, design flaws	3	6	126	Use advanced insulation materials, enhance design for uniform coverage

Item	Function	Potential Failure	Potential Effect of Failure	SEV	Potential Causes of Failure	OCC	DET	RPN	Recommended Actions
Defrosting Technologies	Prevent ice buildup	Inefficient defrosting	Increased energy use, reduced storage space	6	Faulty sensors, inadequate defrost mechanism	4	5	120	Implement advanced defrosting technologies, improve sensor accuracy
Odor Management	Neutralize and eliminate odors	Ineffective odor control	Unpleasant smells, affecting food quality	5	Poor airflow, inadequate filters	3	4	60	Use activated carbon filters, improve airflow design
Water Leakage Prevention	Prevent water leakage	Leakage occurrence	Water damage, mold growth	7	Loose connections, material degradation	2	5	70	Secure connections, use water-resistant materials
Magnetic Door Seal	Ensure tight closure	Seal failure	Energy loss, temperature fluctuations	6	Wear and tear, seal material degradation	3	6	108	Use high-quality seal materials, ensure robust door design

Item	Function	Potential Failure	Potential Effect of Failure	SEV	Potential Causes of Failure	OCC	DET	RPN	Recommended Actions
Data Privacy and Security	Protect user data	Unauthorized access	Privacy breach, data theft	9	Inadequate security measures	2	3	54	Implement end-to-end encryption, use secure communication protocols
Multi-Language Support	Provide language options	Limited language availability	Reduced accessibility, user dissatisfaction	4	Software limitations	2	3	24	Expand language support, ensure easy switching
Packaging and Labeling	Protect during transit	Packaging damage	Product damage, customer dissatisfaction	7	Poor packaging materials, rough handling	4	5	140	Use durable packaging, clear labeling for handling instructions

# Stakeholder Matrix

Stakeholder Name	Contact Information	Impact to Project	Influence to Project	What's Important to Stakeholder	How Stakeholder can Contribute	How could Stakeholder derail the project	Strategy to engage
Person - Business -Organization	Address - Cell# - E-Mail -Association - Contact Person - Phone#	H - M - L	Customer - Industry -Key supplier	Financial - Technology -Influence	Communication - Influence others - Teach others - Key Opinion Leader	Competitor - Financial - Subject Matter Expert	Meetings - Project Updates - Advisory Board
Kim David	Customer service	H	Customer/ Outsourced project service	Product specification, Market analysis	Design contribution	Grant money	Monthly meetings, Reviews
REI	Customer service	H	Strategics	Increase market share	Early input, Advertising	Competition	Conference call

Stakeholder Name	Contact Information	Impact to Project	Influence to Project	What's Important to Stakeholder	How Stakeholder can Contribute	How could Stakeholder derail the project	Strategy to engage
Hitachi Co	Customer service	M	Outsourced Project Services	Expanding their market	Design check	poor caliber	Weekly conference call
Amazon	Customer service	H	Key supplier	Customer satisfaction	Advertising	Making criticisms over the caliber	Design reviews
Target	Customer service	M	Customer	Expanding market	Randomized trials	poor caliber	Advisory board
ACCO Brands Corp	Customer service	M	Strategics	Expand their market	Early input, Advertising	Competition	Conference call
Lubins	Customer service	H	Key supplier	Customer satisfaction	Advertising	Making criticisms over the caliber	Design reviews

Stakeholder Analysis Matrix							
Stakeholder Name	Contact Information	Impact to Project	Influence to Project	What's Important to Stakeholder	How Stakeholder can Contribute	How could Stakeholder derail the project	Strategy to engage
CPSC (CONSUMER PRODUCT SAFETY COMMISSION)	Customer Service	H	Regulators	Quality	Quality check, Safe material used	Competition	Standards Checks
ASTM (American Society for Testing and Materials)	Customer Service	M	Outsourced Project Services	Expanding their market	Design check	Caliber	Weekly conference call
High Design Technologies	Customer Service	M	Regulators	Quality	Quality check, Safe material used	poor caliber	Standards Checks

# Way Ahead

## Prototype Development

- Finalize and test the prototype, emphasizing core functionalities and energy efficiency.
- Refine based on feedback to ensure technical and user requirements are met.

## Competitive Analysis

- Analyze competitors to identify FridgeMate Luxe's market positioning and differentiation.
- Leverage insights to refine product and marketing strategies.

## Business Pitch

- Craft a compelling pitch showcasing unique features, market potential, and ROI.
- Outline financials, including cost, pricing, and forecasted revenue.

## Market Forecast

- Validate market demand through research and trend analysis.
- Define target segments and project sales volumes to inform strategy.

