SHARPFRIDGE :

Intelligent Refrigerator System

Software Development Plan

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**1-INTRODUCTION**

Traditional refrigeration systems are inefficient in maintaining optimal storage conditions for various food items, resulting in significant economic and environmental losses due to premature spoilage and waste. Chain restaurants are especially affected since they need a consistent supply of fresh food. The issue is made worse by the fact that conventional freezers are unable to adjust to changes in humidity and temperature in the surrounding air. Additionally, companies find it challenging to quickly identify and address deviations from ideal storage conditions due to the absence of real-time monitoring and alert systems.

By creating an intelligent refrigerator system that efficiently controls the storage of diverse food products under varying environmental conditions, this project seeks to address these inefficiencies. The system will keep an eye on humidity, temperature, and other variables using cutting-edge sensors. Based on real-time data, the system will maintain the best possible storage conditions for every kind of food by modifying the amounts of humidity and cooling. Additionally, it will deliver messages and alarms in real time for any deviations, enabling quick corrections.

This intelligent refrigerator system's main objective is to guarantee the durability and freshness of food products that are stored, which will minimize food waste and its negative effects on the environment. In comparison to conventional approaches, the system will greatly increase the efficiency and dependability of food storage because to its user-friendly interfaces and strong monitoring capabilities.

**2-OBJECTIVES**

The intelligent refrigerator system aims to address the inefficiencies of traditional refrigeration by implementing advanced monitoring and control mechanisms. The key objectives of this project include;

* Real-Time Alerts and Notifications: Provide a mechanism that notifies users when ideal storage conditions are not met, allowing them to take prompt corrective action.
* Ensure Freshness and Longevity: To maintain freshness and prolong shelf life, keep different foods at the ideal temperature and humidity levels.
* User-Friendly Interface: Design a user-friendly interface to make it simple to monitor and manage the refrigerator system.
* Thorough Testing and Validation: Ensuring the dependability and efficiency of the system requires significant testing and validation.
* Multi-User Access: For convenience and flexibility, allow numerous users to access and control the system at once.
* Accurate Storage Period Determination: Enable the system to calculate accurate storage periods by analyzing the dates that users submit for food production and consumption.
* Customizable Compartments: Allow users to set different compartments for each type of food with adjustable temperature and humidity levels.

**3. HIGH-LEVEL FUNCTIONALTY**

This project's main objective is to create an intelligent refrigerator system that will increase food storage's dependability and efficiency. This system seeks to guarantee the longevity and freshness of food items that are stored while also lowering food waste. The questions that follow can be used to determine the project's main goals:

* Can a system be created that notifies users in real time of any deviations from ideal storage conditions so they can take prompt corrective action?
* Can the system keep various food types at the ideal humidity and temperature to preserve their freshness and lengthen their shelf life?
* Is it possible to design an interface that is simple and intuitive so that users can monitor and control the refrigerator system efficiently?
* Can extensive testing and validation be carried out to guarantee the efficacy and dependability of the system in preserving ideal storage conditions?
* Can the system support multiple users accessing and managing it at the same time, providing businesses with multiple stakeholders with flexibility and convenience?
* Can the system precisely manage food items by assessing the dates of food production and consumption entered by the user to determine the storage period?
* Is it possible to create a system that enables users to designate distinct compartments for every kind of food, each with individualized humidity and temperature settings?

**4-STAKEHOLDERS**

A stakeholder is any individual, group, or organization that has an interest or concern in a particular project, organization, or system. Stakeholders can affect or be affected by the outcomes of the project, and their needs and expectations must be considered and managed to ensure the project's success. In the context of the SharpFridge intelligent refrigerator system, various stakeholders play critical roles, each with specific interests and impacts.

**1. Chain Restaurant Owners/Managers**

Role: Primary stakeholders who are directly impacted by the inefficiencies of traditional refrigeration systems.

Stake: They have a vested interest in ensuring that the intelligent refrigerator system effectively maintains optimal storage conditions, which can significantly reduce food, extend the life of food and minimize economic losses. Their goal is improving operational efficiency and reduce costs associated with spoilage and inventory management.

**2. Restaurant Staff (Kitchen Staff)**

Role: Daily users of the refrigerator system, including chefs, cooks, and other kitchen personnels.

Stake: This group benefits most from the system's user-friendly interface and advanced functionality, which streamline food storage and retrieval processes. By improving the ease of access and organization within the refrigerator, staff can work more efficiently, can benefit from the application and maintain high standards of food safety and quality.

**3. Customers of the Restaurant**

Role: Indirectly impacted by the quality of food served at restaurants.

Stake: Customers have a stake in the freshness and quality of the food items stored in the refrigerator system, as these factors directly affect their dining experience. Consistently high-quality food can lead to increased customer satisfaction and repeat business.

**4. Environmental Conservation Organizations**

Role: Groups dedicated to reducing food waste and minimizing environmental impact.

Stake: These organizations are interested in the effectiveness of the intelligent refrigerator system in reducing food waste and promoting sustainable practices. Successful implementation of the system can help conserve resources, reduce greenhouse gas emissions, and promote a more sustainable food industry.

**5. Suppliers/Vendors**

Role: Providers of food items to chain restaurants.

Stake: Suppliers have an interest in ensuring that the food items they supply are stored properly and maintain their quality, which minimizes losses for both the supplier and the restaurant. Proper storage conditions can enhance the shelf life of products and reduce the likelihood of returns or complaints.

**6. Regulatory Authorities**

Role: Entities responsible for ensuring compliance with food safety and storage regulations.

Stake: Regulatory authorities have a stake in the functionality and reliability of the intelligent refrigerator system to ensure it meets regulatory standards and guarantees food safety. Compliance with these standards is crucial to prevent foodborne illnesses and ensure public health.

**7. Technology Providers**

Role: Companies providing sensor technology, software development tools, and other technical components for the refrigerator system.

Stake: Technology providers are interested in the successful implementation and adoption of their technology within the intelligent refrigerator system. Their reputation and business success depend on the reliability and effectiveness of the solutions they offer.

**8.Competitors**

Role: Other companies developing similar intelligent refrigeration systems or alternative solutions to address food storage inefficiencies.

Stake: Competitors have a stake in monitoring the progress and features of the SharpFridge project to stay competitive in the market. Their reactions and strategies may influence the direction and marketing of the SharpFridge system, pushing continuous improvement and innovation.

**9.Developers of SharpFridge**

Role: Engineers, software developers, and designers who are working on the development, testing, and improvement of the SharpFridge intelligent refrigeration system.

Stake: Developers have a critical stake in ensuring the successful implementation and functionality of the SharpFridge project. Their expertise and efforts directly impact the quality, performance, and user satisfaction of the product. The success of the project can influence their professional reputation, career growth, and potential financial rewards. Additionally, developers are invested in staying ahead of technological advancements and maintaining the innovative edge of SharpFridge in the competitive market

**5- SOFTWARE PROCESS**

**Cross-Functional Team**

Software Engineers: Develop user interface, backend logic for sensor data processing, and real-time alert system.

Hardware Engineers: Design and integrate sensor systems and cooling mechanisms.

Food Storage Experts: Offer expertise in food preservation and optimal storage conditions.

Quality Assurance Specialists: Test and validate SharpFridge's functionalities for reliability and compliance with food safety standards.

**Agile Project Management**

Methodology: Use Agile methodologies for iterative development, frequent feedback, and adaptive planning tailored to hardware-software integration.

**Effective Communication Channels**

Strategy: Establish regular team meetings, virtual collaboration tools, and dedicated platforms for seamless coordination and knowledge sharing.

Cross-functional Meetings: Discuss integration points, align priorities, and address challenges promptly.

**User-Centric Approach**

User Research: Engage stakeholders to understand needs and preferences.

Prototyping and Testing: Conduct iterative prototyping and usability testing to gather feedback and refine the system.

**Robust Testing and Validation**

Testing Strategies: Implement unit, integration, and system testing tailored to the hardware-software integration.

Custom Test Cases: Validate performance under various conditions.

Continuous Monitoring: Log sensor data to detect anomalies and enable proactive maintenance.

* Scrum is an agile framework for managing and organizing complex projects with iterative manner. It emphasizes collaboration, adaptability, and continuous improvement, with key roles such as Scrum Master, Product Owner, and Development Team. Daily stand-up meetings and regular retrospectives enhance communication and efficiency throughout the development process.

metin, ekran görüntüsü, yazı tipi, grafik içeren bir resim

Açıklama otomatik olarak oluşturuldu**Sprint Plan Summary**

**Project Planning and Controlling (22 days)**

Project Scope Definition

Stakeholder Analysis

Budget Management

Risk Assessment

Creating Project Schedule

**Hardware (14 days)**

Identifying Extra Requirements

Vendor Proposal Anaylsis

Evaluation and Vendor Selection

Procurement

**Sensor Integration (28 days)**

Sensor quality selection

Physical Installation

Sensor Prototyping

Developing low-level software bare bones

Integration with low-level software

**User App Design (14 days)**

UX design and Backend

Visual Design

Prototyping

Usability Testing

**Testing and Validation (24 days)**

Test Planning

Test Execution

Defect Tracking

Validation

User Acceptance Testing

**Documentation (14 days)**

User Manual Preparation

Technical Specification

Installation Guide

Training Guide

**Deployment (7 days)**

Training Courses

Deployment

Monitoring and Support

* Using Scrum for our project allows for iterative and incremental development, enabling us to create prototypes before the final product. Collaborative working is facilitated by Scrum, allowing diverse skill sets to collaborate efficiently on both the software and hardware aspects of the project. The focus on customer satisfaction ensures that customers are actively involved and provide feedback at every stage, which is crucial given the project's cost. Continuous improvement and feedback are integral to Scrum, minimizing the cost of adapting to technological changes. Lastly, Scrum's high efficiency and fast delivery accelerate development and ensure timely delivery of product features to customers.

**6-PROJECT STAFFING**

**Project Manager:** Oversees the entire project lifecycle, coordinates between different teams, ensure timelines, budgets and project goals and facilitate communication with stakeholders.

**Software Engineers:** Develop the software components, including the user interface and backend logic.

**Hardware Engineers:** Design and integrate sensor systems and cooling mechanisms. Ensure seamless hardware-software integration. Conduct hardware testing and troubleshooting.

**Food Storage Experts:** Provide guidelines on food preservation techniques and optimal storage conditions. Adapt the refrigerator system for different types of food items. Collaborate with engineers to implement these guidelines.

**Quality Assurance Specialists:** Conduct rigorous testing of the SharpFridge functionalities. Ensure compliance with food safety standards. Identify and document any issues or bugs.

**User Experience (UX) Designers:** Design the user interface for ease of use and efficiency. Conduct usability testing and gather user feedback. Refine the interface based on user research.

**Technical Writers:** Document system functionalities and usage guidelines. Create user manuals and technical specifications. Ensure documentation is clear and comprehensive.

**Scrum Master:** Facilitate Scrum ceremonies and meetings. Ensure the Agile principles are followed. Support the team in removing any impediments.

**Customer Representatives:** Engage with stakeholders to gather requirements and feedback. Ensure customer needs are met throughout the project. Act as a liaison between the development team and customers.

**7-PROJECT RISKS:**

|  |  |
| --- | --- |
| LIKELIHOOD RANK | RISK  DESCRIPTION |
|  | Security breaches : Security breaches compromising user data or system functionality. |
|  | Inaccurate sensor readings: Inaccurate sensor readings leading to improper adjustments in cooling and humidity levels. |
|  | Compatibility issues: Compatibility issues between mobile application and user device. |
|  | Insufficient user training: Insufficient user training leading to misuse or improper handling of the refrigerator system. |
|  | Hardware supply chain disruptions : Hardware supply disruptions affect sensor or hardware component availability. Therefore, producing would be disrupted and finding spare part can be hard. |
|  | Regulatory changes: Regulatory changes impacting food storage guidelines and requirements. |
|  | Technical failures: Fatal technical failures or malfunctions in the refrigerator system. |
|  | Competition: Competition introducing similar or more advanced solutions in the market. |
|  | Consumer shifts: Unexpected shifts in consumer preferences or demands for food storage solutions. |
|  | Budget constraints: Budget constraints affecting the development and deployment of the intelligent refrigerator system. |

|  |  |
| --- | --- |
| IMPACT  RANK | RISK  DESCRIPTION |
|  | Security breaches : Security breaches compromising user data or system functionality. |
|  | Supply chain disruptions : Supply chain disruptions affecting sensor or hardware component availability. |
|  | Technical failures: Unforeseen technical failures or malfunctions in the refrigerator system. |
|  | Regulatory changes: Regulatory changes impacting food storage guidelines and requirements. |
|  | Competition: Competition introducing similar or more advanced solutions in the market. |
|  | Budget constraints: Budget constraints affecting the development and deployment of the intelligent refrigerator system. |
|  | Inaccurate sensor readings: Inaccurate sensor readings leading to improper adjustments in cooling and humidity levels. |
|  | Compatibility issues: Compatibility issues between hardware and software components. |
|  | Insufficient user training: Insufficient user training leading to misuse or improper handling of the refrigerator system. |
|  | Consumer shifts: Unexpected shifts in consumer preferences or demands for food storage solutions. |

|  |  |  |  |
| --- | --- | --- | --- |
| LIKELIHOOD RANK | IMPACT RANK | COMBINED RANK | RISK  DESCRIPTION |
| 1 | **1** | **2** | Security breaches : Security breaches compromising user data or system functionality. |
| 5 | **2** | **7** | Hardware supply chain disruptions : Hardware supply disruptions affect sensor or hardware component availability. Therefore, producing would be disrupted and finding spare part can be hard. |
| 2. | **7.** | **9** | Inaccurate sensor readings: Inaccurate sensor readings leading to improper adjustments in cooling and humidity levels. |
| 7. | **3.** | **10** | Technical failures: Unforeseen technical failures or malfunctions in the refrigerator system. |
| 6. | **4.** | **10** | Regulatory changes: Regulatory changes impacting food storage guidelines and requirements. |
| 3 | **8** | **11** | Compatibility issues: Compatibility issues between hardware and software components. |
| 4. | **9.** | **13** | Insufficient user training: Insufficient user training leading to misuse or improper handling of the refrigerator system. |
| 8. | **5.** | **13** | Competition: Competition introducing similar or more advanced solutions in the market. |
| 10. | **6.** | **16** | Budget constraints: Budget constraints affecting the development and deployment of the intelligent refrigerator system. |
| 9. | **10.** | **19** | Consumer shifts: Unexpected shifts in consumer preferences or demands for food storage solutions. |

The SharpFridge extend faces different dangers and these dangers may influence the victory of the venture. The essential hazard is security breaches that compromise client information and framework usefulness. Furthermore, off base readings from sensors can lead to erroneous alteration of cooling and mugginess levels, which can contrarily influence nourishment quality. Disturbances within the equipment supply chain can disturb generation and complicate component accessibility. Compatibility issues between the versatile application and client gadgets and deficiently client preparing may make the framework helpless to manhandle. Changes in enactment with respect to nourishment capacity may constrain the extend to adjust. Specialized mistakes can decrease the unwavering quality and execution of the framework. Competition within the advertise and sudden changes in shopper inclinations can influence the request for the item. At long last, budget limitations can negatively impact development and sending forms. These dangers have to be be carefully observed and overseen.

**8- NEEDS:**

For SharpFridge to move forward, it was crucial that the computer program requirements arise and continue to ensure the framework works well and meets the customer's diet. Variables such as computer program prerequisites, landmarks, assets, time, assets, efficiency and quality should be recorded. Tuning these features requires intense review using the features/resources/time triangle.

çizgi, diyagram, üçgen, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

The basic idea in entry management is the connection between landmarks, assets and time, often referred to as triangles (see Figure 1). Compatibility features in the PC installation are highlighted by displaying:

- Featured:

Practical details and capabilities that the program must have.

- Assets:

The monetary, developed and human assets of the project were shared.

-Length:

The total amount of time required to complete the task.

Extra assets or a longer amount of time are required to select modern ones. On the other hand, saving assets or time may result in less emphasis or lower quality work in the conclusion section. Any extra features requested by the customer should be seen as an extension of the extension schedule in order to postpone delays and ensure high quality delivery.

**8.1-Software Needs**

**8.1.1. Operating System**

Inserted OS:

The embedded working system (OS) serves as the foundational computer program environment for the SharpFridge, enabling all other computer program components to function. It is tried and true for managing hardware resources, running the control systems, and supporting the client interface. The embedded OS must be lightweight, profitable, and able of real-time execution to handle errands such as temperature and stickiness control, sensor data planning, and client natural.

**8.1.2. Application Software**

Control Computer Program:

This computer program directs the center value of the ice chest, tallying collecting and taking care of data from distinctive sensors (temperature, stickiness, infrared), changing cooling and mugginess levels to protect perfect capacity conditions, and making real-time cautions and takes note for the client.

Client Interface Program:

This computer program gives a user-friendly interface for collaboration with the cooler. It licenses clients to screen and control the refrigerator's settings, see real-time data, and get alerts. The interface must be common and accessible, giving highlights like touch controls, graphical appears, and conceivably voice commands.

**8.1.3. Networking Software**

Security Computer Program:

It combines incredible security measures to modify the program to seal customer data and secure system security and assurance. This includes scrambling the communication channels between the ice chest and its external mechanisms, maintaining confirmation components for continuity of customer identities, and protecting against intrusions and potential cyber hazards.

**8.1.4. Firmware**

Gadget Firmware:

Firmware is fundamental for controlling the refrigerator’s gear components, such as sensors and cooling systems. It executes system basis, manages hardware brilliantly, and ensures that all embedded systems work precisely. Firmware redesigns can in addition grant execution changes and unused highlights over time.

**8.1.5. Analytics and Reporting Software**

Information Examination Apparatuses:

These devices analyze patterns in sensor data, detect patterns, and generate information that can help optimize refrigerator operations. By understanding how temperature and humidity are changing, the program can make intelligent changes to improve food preservation and necessity.

Announcing Computer program:

This program generates dirty reports on different perspectives of the refrigerator’s operation, such as temperature and stickiness conditions, feeding capacity conditions and overall system application. These reports are profitable for complying with food safety rules and making informed choices regarding system maintenance and upgrades.

**8.1.6. Integration Software**

API Integration Instruments:

APIs strengthen SharpFridge’s integration with external systems such as the xchange organization program or Master Housing Stages. This enables advanced features such as modified replenishment alerts or integration with other sharp mechanisms within the home.

Middleware:

The middleware acts as a bridge that ensures stable communication and data xchange between specific computer program components within the SharpFridge building. It enables effortless data flow between the control program, client interface and analytics, resulting in improvements in shared system value and customer loyalty.

**8.2-Hardware Needs**

**8.2.1. Sensors**

Temperature Sensors:

These sensors are essential for monitoring the interior temperature of the cooler to ensure that it remains at a perfect level for food preservation. They donate the real-time data provided by the control computer to their livelihood to change the cooling system when necessary.

Stickiness Sensors:

Turbidity sensors classify the sticky mass inside the cooler and ensure that it remains at the ideal level until the food breaks down. Maintaining stickiness control is crucial to preserve the freshness of typical produce, vegetables and other perishable goods.

Infrared Sensors:

Infrared sensors detect the proximity and forward movement of objects inside the cooler. They are used to effectively control the required usage by varying the incremental cooling based on the known location and help in warehouse organization by completing tasks inside the cooler.

**8.2.2. Cooling System**

Compressor:

The compressor is the essential component capable for cooling. It compresses the refrigerant, raising its pressure and temperature, and after that circulates it through the condenser and evaporator to cool the refrigerator's insides.

Evaporator:

The evaporator encourages the exchange of warm from the interior of the fridge to the refrigerant, cooling the inner environment. It plays a significant part in keeping up the specified moo temperatures.

Condenser:

The condenser changes over the refrigerant from a gas back into a fluid, discharging warm exterior the fridge. This handle is fundamental for the ceaseless cooling cycle, guaranteeing that the insides of the ice chest remains cool.

**8.2.3. User Interface**

Show Board:

The show board gives a user-friendly interface for checking and controlling the refrigerator's settings. It appears data such as current temperature, mugginess levels, and system alarms, permitting clients to form alterations as required.

Input Gadgets:

Input gadgets, such as touchscreens or buttons, permit clients to enter data like food type, mass, and buying date. This information is utilized by the control computer program to screen and oversee the substance of the fridge more precisely.

**8.2.4. Communication Equipment**

Wi-Fi Module:

The Wi-Fi module enables the refrigerator to put through to the web, permitting for real-time checking and inaccessible get to by means of smartphones or other gadgets. This network moreover bolsters information transmission to and from client gadgets.

Ethernet Harbour:

The Ethernet harbour gives a solid wired organize association, guaranteeing steady communication with outside frameworks or servers. It can be used for secure information transmission and integration with other organized gadgets.

**8.2.5. Supporting Equipment**

Control Supply:

The control supply gives the essential electrical control to function all components of the fridge framework. It guarantees that the framework runs proficiently and dependably.

Cooling Fans:

Cooling fans help in keeping up wind stream and temperature direction inside the fridge. They offer assistance disperse cool discuss equally, avoiding hotspots and guaranteeing reliable cooling all through the refrigerator.

**8.2.6. Data Storage**

Memory modules store framework arrangements, client inclinations, and authentic information. This information is utilized for examination and optimization of the refrigerator's execution.

ROM (Read-Only Memory):

ROM is utilized to store framework setups, firmware, and critical software components that don't require visit adjustment. It guarantees information integrity and system solidness.

Disks (HDDs/SSDs):

Hard disk drives (HDDs) or solid-state drives (SSDs) give non-volatile capacity for logging sensor information, framework logs, and client inclinations. These disks offer changing capacities to oblige verifiable information for investigation and optimization, as well as framework reinforcements.

**8.2.7. Environmental Monitoring Equipment**

Discuss Quality Sensors:

In arrange to ensure freshness and dodge odors or defilement, these sensors keep an eye on the condition of the nourishment inside the fridge. They back the upkeep of nourishment capacity conditions that are sterile.

Light Sensors:

The refrigerator's lighting is recognized by light sensors. By altering the interior lighting, it maximizes vitality effectiveness and makes a difference shield nourishment from breaking down from delayed presentation to light.

**8.2.8. Power Management**

Voltage Controller:

The voltage controller stabilizes the approaching control supply to guarantee reliable operation of electronic components. It secures the fridge from control changes and surges.

Battery Reinforcement:

Battery reinforcement gives crisis control amid blackouts, keeping up basic framework capacities and information judgment. It guarantees that the fridge proceeds to function incidentally until control is reestablished.

**8.2.9. Physical Infrastructure**

Racking units organize nourishment things inside the refrigerator, optimizing capacity space and making it easier to oversee stock. They are outlined to be flexible to oblige different sizes and sorts of nourishment.

Entryway Seals:

Entryway seals guarantee appropriate fixing of the fridge entryways to avoid temperature spillage. They offer assistance keep up steady cooling productivity by minimizing discuss trade between the interior and outside of the fridge.

**8.2.10. Safety Features**

Entryway Caution:

The entryway caution cautions clients when the cooler entryway is cleared out open for expanded periods. This dodges temperature instabilities and food rot by ensuring that the entryway is closed right away.

Crisis Shut-off Switch:

In the event of a malfunction or security issue, the emergency shut-off switch is licensed to initiate control cut-off. It provides a basic security tool to safeguard the customer as well as the refrigerator.

**8.3-Support Needs**

**8.3.1. Technical Support**

Help with Equipment Setup and Integration:

Specialized bolster is fundamental for the correct establishment and integration of the SharpFridge equipment components. This incorporates setting up sensors, cooling frameworks, client interfacing, and communication hardware to guarantee they work accurately and cohesively.

Direction on Program Advancement and Investigating:

Creating and keeping up the SharpFridge program requires master direction. Specialized bolster gives help in composing, testing, and investigating program to guarantee it works easily and proficiently.

Investigating Help for Sensor Calibration and Information Elucidation:

Exact sensor calibration is noteworthy for perfect execution. Specialized support makes a distinction in calibrating sensors precisely and disentangling the data they create, ensuring strong watching and control of the refrigerator's interior environment.

**8.3.2. Procurement Support**

Help in Distinguishing Trustworthy Providers for Equipment Components:

Rollback encourages the look for dependable sellers for the different equipment components required for SharpFridge. This guarantees the utilize of high-quality parts and contributes to the in general quality and execution of the cooler.

Back in Arranging Contracts and Securing Favorable Estimating for Hardware Obtainment:

A sensible approach can result in base compensation being charged within the shops. Buyback gives a differentiate to rationalize contracts and increment sensible costs for equipment components, optimizing the venture budget.

Coordination with Merchants to Guarantee Convenient Conveyance of Equipment Components:

To guarantee densification of organization, sensible advancement of components is fundamental. Rollback guarantees that a switch remains protects from delays within the stream of SharpFridge's development and action and gives merchants the opportunity to guarantee that all hardware components arrive on time.

**8.3.3. IT Support**

Arrangement of Arrange Framework for Information Transmission and Farther Get to:

IT bolster is significant for setting up the arrange foundation that permits information transmission and farther get to. This incorporates arranging switches, switches, and other arrange gadgets to guarantee solid network.

Setup of Organize Security Measures to Secure Touchy Information:

Ensuring client information and framework keenness is foremost. IT bolster arranges organize security measures such as firewalls, encryption, and secure get to conventions to defend against cyber dangers.

Help with Setting Up Cloud Capacity or Server Foundation for Information Capacity and Reinforcement:

Eliminating and securely backing up data is essential to maintaining the uncompromising quality of the system. IT support makes the difference in setting up cloud capacity or setting up servers to store customer trends, sensor data and system logs and ensuring that the data is sponsored and successfully accessed.

**8.3.4. Training and Education**

Training Sessions for Conclusion Clients on How to Function SharpFridge Viably:

Providing consumers with direct support ensures they can use SharpFridge to its full potential. During training sessions, customers can learn how to use the refrigerator, adjust settings, and respond to alerts and messages.

Instructive Materials and Documentation to Help Clients in Understanding Framework Functionalities and Investigating Common Issues:

Comprehensive instructive materials, such as manuals and online instructional exercises, offer assistance clients get it the functionalities of SharpFridge. These assets too give direction on investigating common issues, improving client certainty and fulfillment.

Continuous Bolster and Upgrades to Keep Clients Educated Around Modern Features and Best Hones:

Continuous rollbacks and upgrades are essential to maintaining user engagement and satisfaction. Providing progressive upgrades with near-modern features and best-in-class functionality makes the difference in helping customers get the most out of their SharpFridge.

**8.3.5. Maintenance and Service**

Planned Support Administrations to Guarantee the Proceeded Usefulness and Effectiveness of SharpFridge:

Standard support is pivotal to guarantee that SharpFridge works effectively and without interferences. Planned support administrations offer assistance anticipate potential issues and amplify the life expectancy of the refrigerator.

Quick Reaction Benefit in Case of Equipment or Program Malfunctions to Minimize Downtime:

Fast response to breakdowns minimizes downtime and keeps up client believe. A committed benefit group gives quick help to resolve equipment or program issues instantly.

Guarantee Support for Equipment Components and Repairs as Required:

Guarantee back offers peace of intellect by covering the taken a toll of repairs and substitutions for inadequate equipment components. This guarantees that any issues are settled without extra monetary burden on the client.

**8.3.6. Regulatory Compliance Support**

Direction on Administrative Prerequisites Related to Nourishment Security and Capacity Benchmarks:

Following to nourishment security and capacity directions is basic for compliance. Administrative compliance back gives direction on the significant guidelines and prerequisites that SharpFridge must meet.

Help in Guaranteeing Compliance with Important Industry Directions and Measures:

Compliance with industry controls is basic for advertise acknowledgment and client security. Bolster in this range makes a difference guarantee that all viewpoints of SharpFridge meet the fundamental administrative benchmarks.

Documentation Bolster for Reviews and Reviews to Illustrate Adherence to Administrative Necessities:

Legitimate documentation is fundamental for illustrating compliance amid audits and assessments. Administrative compliance bolster helps in planning and keeping up the necessary documentation to demonstrate adherence to significant regulations.

**9. Software Measurements**

|  |  |  |
| --- | --- | --- |
| Measurement  Type | Description | Example  Measurements |
| Effort | Measure of time and resources invested in project development and testing. | Total person-hours spent on development and testing |
| Schedule Adherence | Assessment of project timeline adherence compared to compliance with project timeline. | Variance between planned and actual project timeline |
| Code Reuse | Evaluation of how much pre-written code is used over the code written in the project. | Percentage of code reused from previous projects or libraries |
| Change Data | Number of changes made to the project over time and their percentage compared to all changes. | Number of changes implemented over time compared to oncoming sprints. |
| Product Quality | Assessment of system quality through defect detection. | Number of defects detected during testing. |
| Testing Effort | Measurement of time and resources allocated to testing activities. | Total hours spent on testing activities |
| Product Size | Completed and estimated size of media, documentation, classes and representation of actual size. | Number of components  Required documentation size  Size in bytes |
| Data Management | Managing and calculating cost, required tool’s cost and estimated data required by each sprint and testing. | Cost  Tool cost  Length of project |

**10**. **Software Tools**

**10.1 Mobile Push Notifications**

**Tool Cost/Training/Functionality Data**

|  |  |  |  |
| --- | --- | --- | --- |
| Tool | Amazon SQS | Redis | Firebase |
| Cost | **$1,552.42/mo** | **$600/mo** | **$450/mo** |
| Training Days | **10** | **7** | **23** |
| Functionality | **90** | **50** | **40** |

**Normalized Cost/Training/Functionality Data**

|  |  |  |  |
| --- | --- | --- | --- |
| Tool | Amazon SQS | Redis | Firebase |
| Cost | **100** | 38.7 | 29.0 |
| Training Days | 43.5 | 30.4 | **100** |
| Functionality | **100** | 55.5 | 44.4 |

In order to send push notifications to the users via mobile application (password change request, fridge messages via cloud computing etc.) alternatives were analyzed. Since we are planning to use DynamoDB as our main database system provided by Amazon, Amazon Simple Queue Service (SQS) was selected. Also, it is more robust and flexiable.

**10.2 Database Integration**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tool Cost/Training/Functionality Data   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Tool | MongoDB | MariaDB | Oracle | DynamoDB | | Cost | $300/Mo | $430/Mo | $460/Mo | $930/Mo | | Training Days | 3 | 5 | 7 | 8 | | Functionality | 70 | 40 | 60 | 80 |   Normalized Cost/Training/Functionality Data   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Tool | MongoDB | MariaDB | Oracle | DynamoDB | | Cost | 32.2 | 46.2 | 49.4 | **100** | | Training Days | 37.5 | 62.5 | 87.5 | **100** | | Functionality | 87.5 | 50 | 75 | **100** |   Normalized Tool Graph |

Even though user data is stored in locally, in order to access it from somewhere else and compute the data which are coming from the sensors in a cloud, Amazon DynamoDB was chosen. Moreover, it offers globally distributed servers. Therefore, it reduces the response time while accessing in a truck.

**10.3 Project Task Management**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Tool Cost/Training/Functionality Data   |  |  |  |  | | --- | --- | --- | --- | | Tool | Asana | Trello | Jira | | Cost | $250/Mo | $175/Mo | $160/Mo | | Training Days | 1 | 1 | 5 | | Functionality | 70 | 60 | 80 |   Normalized Cost/Training/Functionality Data   |  |  |  |  | | --- | --- | --- | --- | | Tool | Asana | Trello | Jira | | Cost | **100** | 70 | 64 | | Training Days | 20 | 20 | **100** | | Functionality | 87.5 | 75 | **100** |   Normalized Tool Graph |

Jira has selected due to its support for agile development. Furthermore, it satisfies all the functionality with an affordable price.

**10.4 Programming Languages**

This project consist of three major elements which are mobile application, fridge firmware and API between database and mobile app.

**10.4.1 Mobile application**

Between native languages for two operating systems – Kotlin for Android, Swift for IOS – and cross-platform languages ,React Native is selected due to its less cost and integrity with Django.

**10.4.2 Fridge Firmware**

C++ is selected for embedded system due to its high-speed and efficiency. Fridge will contain an ARM Cortex-A72 processor. It will run Linux based, Raspbian OS without GUI. Interior computer will be able to connect to Internet.

**10.4.3 API**

Djano will be used communication between database and mobile application. React Native supports Django natively. Since Django does not support non-relational databases, boto3 will be used for communication between database and API.

metin, ekran görüntüsü, sayı, numara, yazılım içeren bir resim

Açıklama otomatik olarak oluşturuldu**11. PROJECT SCHEDULE**

**Figure 1: Schedule of the Project**

ekran görüntüsü, çizgi, diyagram, öykü gelişim çizgisi; kumpas; grafiğini çıkarma içeren bir resim

Açıklama otomatik olarak oluşturuldu

**Figure 2 : Gantt Chart of the Schedule**

**12. EFFORT AND COCOMO CALCULATIONS**

* **Software Pricing**

|  |  |
| --- | --- |
| **TOOL NAME** | **PRICE** |
| **Amazon SQS** | $7,762.1 |
| **DynamoDB** | $4,650 |
| **Photoshop CC** | $**300** |
| **Jira** | $800 |
| **Total:** | $13,512.1 |

* **Effort Pricing**

|  |  |
| --- | --- |
| **PERSON** | **PRICE** |
| **Software Project Manager** | **5** x $ 3500 = $ 17,500 |
| **Business Analyst** | **1** x $ 2,500 = $ 2,500 |
| **Lead designer** | **2** x $ 2,500 = $ 5,000 |
| **Front-End Developer** | **3** x $ 2,800 = $ 8,400 |
| **Back-End Developer** | **3** x $ 3,000 = $ 9,000 |
| **Test Engineer** | **2** x $ 2,000 = $ 4,000 |
| **Total** | $ **46.400** |

* **Additional Costs**

**Office , Network and additional expenditures :** approximately $12.000 for 5 months .

* **TOTAL :** $13,512.1 + $46,400 + $12,000 = $71,912.1

**13. PROJECT PAYOFFS**If the project is successfully implemented:

•⁠ ⁠Users will experience reduced food waste, saving money and resources.

•⁠ ⁠Energy efficiency will be enhanced, resulting in cost savings and environmental benefits.

•⁠ ⁠User satisfaction will improve with real-time alerts ensuring food freshness.

•⁠ ⁠The company will establish leadership in smart home technology, opening new markets.

•⁠ ⁠Team members will gain expertise in sensor tech and UI design, boosting future projects.  
  
**14. USER INTERFACES**metin, mobil telefon, ekran görüntüsü, mobil cihaz içeren bir resim

Açıklama otomatik olarak oluşturuldumobil telefon, ekran görüntüsü, mobil cihaz, telefon içeren bir resim

Açıklama otomatik olarak oluşturuldumetin, mobil telefon, İletişim Cihazı, mobil cihaz içeren bir resim

Açıklama otomatik olarak oluşturuldumobil telefon, metin, mobil cihaz, İletişim Cihazı içeren bir resim

Açıklama otomatik olarak oluşturuldu**mobil telefon, metin, ekran görüntüsü, mobil cihaz içeren bir resim

Açıklama otomatik olarak oluşturuldumetin, ekran görüntüsü, mobil cihaz, İletişim Cihazı içeren bir resim

Açıklama otomatik olarak oluşturuldu**

**15. CONCLUSION**This document explains in detail everything needed to understand this project. High-level functionality, stakeholders, project staff distribution, project needs, trade-offs, software process, requirements, detailed project schedule, measurements, risks, software tools, and payoffs are all clearly outlined. Following this document will be highly beneficial for the project manager throughout the development process.