IS 636 – 02: Structured Systems Analysis and Design

Problem Analysis and Requirements Document

Managing Grocery Inventory/Supply & Demand

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I. Introduction

a. Problem Definition

Freshmart is a privately-owned supermarket chain known for selling the best and the organic products to its customers. Today, there has been a lot of competition among the supermarket industries related to the quality of the food, cost of the food, varieties of products etc. To provide the customers with the fresh and healthy products, supermarkets restock their food and products on the regular basis. The main basic problem in the food industry is to manage the supermarket with the right amount of food restocking so that the food does not go waste neither there is shortage of food products. The inventory of the supermarket should be maintained, that is all the items should be in stock and to save the items from damaging. We have around 850 million individuals undernourished, and this number is expanding every year. The one in every eight American is starving from food, about 40 % of the food is never consumed and there are many people to feed. The statistics also express the fact that each year on average, 400 pounds of food is wasted every year. This is said to be irresponsible and expensive too. Growing, processing, transporting, and discarding of that uneaten food has an annual estimated cost of $218 billion, costing a household of four an average of $1,800 annually [13].

Food wastage has significant consequences in the present world. The massive food wastage is because of the following reasons: overproduction, spoilage and expiry. The consequences are been faced by the supermarket chains as they see loss in their business because the products have not been sold and had to be thrown away as they have expired, or they are overpriced. This consequence could be handled and prevented by maintaining the records of the food products that are been sold on the regular basis and which are sold on just the occasions.

Also, business and sales are one of the crucial factors when leading a supermarket. Food wastage and business profit can go hand in hand as they are dependent on one another. If the food is not wasted and sold in the limited time period the company won't incur any loss, but in order to gain some profit the company will have to restock the food properly specially during festival season and during holidays. We all need to understand that there are people out there who are craving for just one meal a day.

b. Project Scope and Justification

The project scope involves creating a system that tracks the food products sold, purchases, sales etc. so that in future the products are not thrown due to the short shelf life or there is no shortage of the item either. If these goals are achieved there is minimum wastage of food and simultaneously

the profits and sales would be increased when there is proper amount of food available. Also, the food does not go to waste. We can come up with some ideas like the common daily items which are required for example milk, bread, eggs, etc. should be placed in front of the aisle so that it is easy for the customers to pick up and are easily perishable as well. The employees assigned for the inventory department must take care of the product count, shipping, arrival, sales, purchase, wastage etc. [20] The main aim of the project is to feed millions with the tons of the food that has been wasted and disposed of into landfills.

There can be grocery store card which will be useful when the customers purchase something and every time there is a purchase made from the card, the customer will earn some points. There can be rewards according to the points earned. Therefore, a customer will receive a notification in the application where he will be made aware of his/her points earned and the discount available to them in exchange of those points. To remain competitive and make profit in the business the easiest way to do so is to get software for the business that will reduce the workload on the employees as well help in faster billing, accounting, managing inventory, tracking customers, tracking employees, tracking profit, tracking expenses, reducing business cost etc. [20] One of the most used software in the supermarket is the reach accounting software which is easy to use. There are many restaurants around the world which follow the rule of imposing a fine on its customers if the food is left uneaten. The leftover food in the supermarkets also means the wastage of resources along with the wastage of food. So, our main concern of the project is to reduce the amount of the food wastage by selling the food products on time and also increase the revenue of the supermarkets.

II. Feasibility Analysis

In this section we will be discussing the technical, economic, and organizational feasibility of the project and understand the needs, requirements, risks the organization might face. Feasibility analysis guides the organization whether to proceed with the project and if all the requirements are met.

a. Technical Feasibility

Technical feasibility focuses on the technical resources that the organization will require to fulfill the project requirements. It helps in determining whether the system can be designed, developed, and installed by the team members. Is the team capable of doing so and if not, what are the factors considered so that the project does not get delayed? Technical feasibility also includes the assessment of the software, hardware and other technical requirements of the system [14].

2.1.1 Familiarity with the application

When adopting a new technology there is always some risk involved. When the project team members are not aware of the new technology or have limited skills towards it, there are greater chances of the project been manipulated. The role of the analyst is to gain more knowledge about

the technology and get a thorough understanding of what are the project requirements and what needs to be delivered. If the project requirements are listed wrong it may lead to major changes in the design, development and implementation phase of the SDLC project [15, Pg.19]. According to the concept of "cost of change", any transition implemented in the definition phase might cost 0.2 times the cost, any transitions implemented in the definition phase might cost 1.2 to 2 times the cost, whereas the transitions that are implemented after the release of the product would cost 50 to 60 times the cost. This can incur huge loss to the organization and also results in delaying the delivery of the product [16].

2.1.2 Familiarity with technology

The technologies that would be used are an important factor to be considered in the project. When the new technology is adopted there are severe chances of the project been delayed and more risks and problems may arise. If the existing technology is been used the chances of risk are reduced. But due to the lack of experience in the technology or lack of skilled personnel in the organization there are chances of the project been extended. The problem to this solution would be to purchase the product or take help for the project from vendors and consultants. Therefore, it is essential to understand and know what we have and what we need to do. [15, Pg.19]

We will develop an application that will allow the supermarket officials to keep a track of the stocked food item with all the product details and more importantly its expiry date. It will update the application as the products will sell and will show how much items are still left so if the items are in more numbers or a particular product has not been sold for a long period of time or customers do not buy it more often the supermarket officials will not stock up that item. Also, it will help in knowing which products are been sold when so that those items are stocked up during those festive occasions. To make sure this application is easy to use, the analyst must make sure that the team working on it are very well versed with the basic knowledge of using operating systems like Windows, iOS etc. Also, to make the application user friendly the organization must assign this task to the employees who are expertise in UI/UX design.The backend of the application is an important factor in this project as the system would be updated with each product sold. So, it is important for the organization to assign team members on this task who are skilled with the back-end technologies like PHP, Java etc. [17]

2.1.3 Project Size

Project Size is a significant factor while calculating the number of the members needed on the development team, the time needed to complete the project, or the number of the features involved in completing the application. The larger the project there are more risks involved and higher chances of certain important requirements been misunderstood or overlooked. Therefore, it is important for the larger projects to have employees who are highly skilled or have expertise in the technology. [15, Pg.19].

2.1.4 Compatibility

To check if the system is compatible, the analyst should check whether the new technology in the organization is able to integrate with the existing system. It should ensure that the integration of the two technologies won't result in risk in future. The new technology should be able to use the data of the existing new technology so that it will fetch all the data from the previous system [15, Pg.19].

2.2 Economic Feasibility

Economic feasibility allows the company to assess the project's cost, advantages, and viability before funding for that project is considered. This also guarantees unbiased project assessment and improves the integrity of the project, which implicitly allows decision-makers to identify what the potential economic gains of this project would be for the organization [14]

2.2.1 Development Costs

There is no specific amount calculated as to how much it will require to develop an application. There are many factors taken into consideration while developing a project such as the project demands, hiring resources and deciding the features of the applications. It is observed that the average cost in developing an android application is $12,500, an iOS application is $16,000 and for windows, the application is $10,000. It is observed that developing the iOS application cost is much higher than that of an Android application because the code writing is complex in iOS devices [18].

Also, adding more features to an application automatically increases the cost of the applications. For example, a developer develops an application that works both online and offline where an online application costs higher than the offline base application because the online application requires several features like push-notifications, payment-gateway integration, CRM integration and Google API integration.

2.1.2 Operational Costs

These are the tangible costs that are necessary to operate the system. Operational costs include Software upgrades, Software licensing fees, Hardware repairs, Hardware upgrades, Operational team salaries, Communications charges, and User training. Google's play store needs $25 as a one-time charge to keep the app on the play store, while the Apple store needs $99 annually to keep the app on the Apple store. There are some hidden costs of creating software such as recurring hosting fees and maintenance of content delivery network (CDN) that range from $5000-12000 and annual charges for push notifications costs around $24000. The main reason for sending the push notification is to gain more profit in the business. No application is perfect, as there are certain bugs and errors that need to be resolved. The developer team must fix those errors and bugs. The development team tries it best to ensure the security and integrity of the application so that the

hackers do not hack the system. Moreover, any updates in the application in the future would cost $24,000 annually, for the android and iOS platforms might cost nearly $10,000 annually. The cost for development tools, libraries, and support is $12,00 minimum [18]. So, the overall operational costs of approximately $768,34.

Total Cost = Development Costs (Software Licenses + Server Software + Development labor) + Operational Costs or Maintenance costs

= 532,20 + 768,34

= 130,054 USD

2.1.3 Cash Flow Analysis

Estimating the value of the project will help in analyzing and judging on the benefits and costs pertaining to the project. Therefore, the worth of the project has to be measured over time.

	2020	2021	2022	2023	Total
Total Benefits		70000	90000	90000	250000
Total Costs	130054	30000	32000	35000	227054
Net Benefits	(130054)	40000	58000	55000	22946
Cumulative Net Cash Flow	(130054)	(40000)	(47000)	22946	

Assuming the system is currently being built in 2020, which is costing upto $130054. Since, the year 2020 is in the initial phase of the project there are benefits in the following year. Once the implementation of the system begins, then the net benefits are calculated accordingly to predict the cumulative cash flow that lets us determine the Return on Investment (ROI) and Break-Even Point (BEP). [15, Pg. 20]

2.2.3.1 Return on Investment

The average rate of return on the money invested in the project is calculated to understand the benefits that are obtained by taking up the project.

ROI = (Total Benefits - Total Cost)/(Total Costs) [15, Pg. 20]

= (250000 – 227054)/(227054)

= 10.10%

2.2.3.2 Break-Even Point

This calculates the number of years it has taken for the firm to trace back to its initial investment in this project from net cash flows.

BEP = (No. of years of negative cash flow) + ((The positive year's Net Cash Flow-The positive year's Cumulative Cash Flow)/(The positive year's Net Cash Flow)) [15, Pg. 20]

= 2 + ((55000-22946)/55000)

= 2.58 years

2.3 Organizational Feasibility

Analysis of the organizational viability deals with the legal and business considerations which would affect the project. In addition, it helps to understand how users embrace the product, how the stakeholders are involved, a strategic framework that offers insights between project and business plan and describes the risks from a legal perspective [15, Pg. 26]

2.3.1 Project Sponsor

The project sponsor for this project will be the Director of the Freshmart. The sponsor has agreed to take the project lead, monitor the progress and provide the feedback on time. Director will also be the bridge to get the feedback from the stakeholders and contribute actively to the organization of meetings.

2.3.2 Stakeholder Groups

The stakeholder groups that will be taken into consideration are:

1. Board of Directors
2. Inventory Management
3. Maintenance Personnel
4. Vendors

2.3.3 Legal Obstacles

The biggest legal challenge for this project is to safeguard data collection from different sources. Also, it is vitally important to ensure the privacy and the integrity of the user's data in the project. The Director has explained the legal implications that occur in case of security breach. In addition, some personal identifying information might also be present in some data that we collect online to analyze the effects [19]. As stated in the General Data Protection Regulation about data risk management, no illegitimate data can be used.

2.3.4 Time Constraint

The time constraint of one year should be there for the implementation of the solution. In this time-bound step we will determine the specifications, project analysis, design, implementation, coding and testing. For this project we have selected Incremental Iterative Model, therefore, one year would be enough to complete the SDLC methodology.

b. Quantified Risk Assessment

- There might be a shortage of certain food products like chocolates, ice cream, cookies during Christmas, Halloween or Easter.
- There will be wastage of food if the food is not sold before the expiry of date.
- An unforeseen fault with the product might deter our sales – for e.g., If the product has an unagreeable outcome, or if there are issues with delivery or any issue with the product's texture or odor. In the case of contamination, we would be unable to use that batch.
- Risk of the sales increases when the products are not sold on time which may lead to loss in the organization.
- There might be a breakdown of equipment in the supermarket like a refrigerator. We have to keep an extra machine ready so that the food is not thrown away or wasted.
- There might be downtime on the website due to the heavy usage of the website or a huge traffic in the network.
- Major changes in the requirements during the implementation phase.
- Lack of skilled personnel in the project.
- There are chances of the website or the application been hacked.
- The estimation and scheduling of the project is not done properly.
- Inability to scale our project as per the requirement.
- If we increase our scale, we will need to be highly mechanized, which increases investment, labor costs for training to handle sophisticated equipment and maintenance costs. If an equipment breaks down, the cost of fixing it would be high.

- Lack of user involvement, leading to food wastage and loss in the business.
- Lack of communication gap among the team members can lead to misunderstanding and some major important points have been missed.
- A lot of competition in the market.
- A server can go down at the time of project.
- Unavoidable risks like the loss occurred during the natural calamity or unforeseen circumstances.

c. Size, Effort, and Schedule Estimate

Estimating the size of software is an important part because it is related and dependent to predict the effort and schedule in future which is essential to build a project. There are different measures used to estimate the size of the project which are

Processes in Data flow diagrams: The data flow diagrams allow us to view the functional perspective of a product. This also provides data about the input and output of each process and entity

Functional points : Analyzing the type of the functions and their number are used to find the count. So we need to find the Function point count and compute the value of adjustment factor, Total degree of influence, Count of the number of functions of each type. These are all the steps in function point analysis. This needs to be used in early stages of planning and it is independent of programming languages.

Lines of Code: This size is determined by comparing the existing products with the new one, both of the same kind and then used to predict the accurate size required including the other parts of software and then sum it up to achieve the total size. It's very simple and easy to use and is close to developer's perspective.

So in the approaches mentioned above we will consider the functional point approach that is required to obtain detailed information about the system and we can determine the required data at our disposal after analyzing the requirements. Also, this method is used to estimate the size of the new system which will be necessary to determine the time the project will require and the effort which will be required to complete the system. It has a 3 step process where

1.Project manager estimates the size of the project in terms of number lines of code of the new system.

2.In terms of number of person-months we can convert the size estimate into the amount of effort required to develop the system.

3.In terms of number of months from start to finish the estimated effort is converted into an estimated schedule time.

The scope of the project helps us determine the detailed data about the constraints to be processed and controlled , performance parameters, functions used to perform. The objectives are that the information system would have advanced algorithms to calculate the data of people in need of food with particular demands. Also determines the data inputs which allows the system to calculate a particular time where the supplies last and need to be stocked up again. Also the availability of that product in the inventory.

We can calculate the total unadjusted function points (TUFP) and then use the adjusted project complexity (APC) to get the total adjusted function point(TAFP) using the formula TAFP=(APC)*(TUFP). Then use the formula (LOC)=(Approx. number of LOC per function point)*(TAFP).Then finally calculate the effort in terms of person/month by using the scheduled time(months) by using the formula 3.0*person-months. Then this estimated and scheduled time is used for the rest of the phases analysis, design and implementation phases.

III. SDLC Methodology Selection and Justification

The Systems Development Life Cycle (SDLC) is the way toward deciding how a data framework (IS) can bolster business needs, how to manufacture and structure a framework that meets its objectives agreeably. It's a model that depicts all the stages required to carry the venture from initiation to fulfillment. These stages are Planning, Analysis, Design, Implementation and Maintenance. Examination, structure and usage stages are viewed as the core of any SDLC. Each stage in itself is made out of a progression of steps which depend on procedures that produce expectations. Following are the SDLC methodology choices were explored thinking about the issue proclamation and the necessities:

3.1 Waterfall Model

The Waterfall Model is viewed as a conventional methodology in SDLC. Actually, it was the principal model which was broadly utilized in the product business. It is partitioned into stages and yield of one stage turns into the contribution of the following stage. [1] The greatest disadvantage of this model is that little subtleties left deficient can hold up the whole procedure.[2] This model thinks that one stage can be begun after consummation of the past stage. That is the yield of one stage will be the contribution to the following stage. In this manner the development procedure can be considered as a successive stream in the waterfall. It comprises of these 7 stages:

1. Planning
2. Analysis
3. Logical Design
4. Physical Design
5. Implementation
6. Testing
7. Maintenance

This model permits iteration between each progression before it turns over to the following stage. Since the arranging stage is the primary stage, all the necessities are known and thought of from the earliest starting point. The key burdens are that the structure must be totally determined before programming starts, quite a while slips by between the fulfillment of the framework proposition in the analysis phase and the delivery of framework, and testing might be dealt with comparatively as an untimely idea in the implementation phase. [3]

In the waterfall model, it is obligatory to remove the sign from the deliverables of each stage. Starting today, the greater part of the ventures are moving with Agile and Prototype models, Waterfall models despite everything holding useful for littler activities. [4]

3.2 Incremental Iterative Development Model

In the Iterative model, iterative procedure begins with a basic execution of a little arrangement of the product prerequisites and iteratively improves the developing variants until the total framework is actualized and fit to be sent. An iterative life cycle model doesn't endeavor to begin with a full determination of prerequisites. Rather, improvement starts by indicating and actualizing a piece of the product, which is then audited to distinguish further prerequisites. This procedure is then rehashed, delivering another rendition of the product toward the finish of every iteration of the model. [5] To simplify the comprehension of this model, consider the periods of the cascade model and circle the Analysis, Logical Design, Physical Design and Implementation stages. Since there are various emphases of stages, this procedure is depicted as "Gradual Iterative". In each cycle the necessities are returned to, structures are restored and testing's are completed until the product capacities according to the prerequisite.

In an Iterative Incremental model, at first, a halfway execution of an absolute framework is built so it will be in a deliverable state. Expanded usefulness is included. Deformities, assuming any, from the earlier conveyance are fixed and the working item is conveyed. The procedure is rehashed until the whole item improvement is finished. The redundancies of these procedures are called iterations. The input from the partners permits to screen if the advancement of the framework is according to the prerequisites or not. Exceptionally talented assets are required for actualizing Incremental Iterative Development model. [5]

3.3 Agile Model

Agile system is a training that advances a consistent cycle of improvement and testing all through the SDLC. Both improvement and testing exercises are simultaneously not normal for the Waterfall model. [6] The structure of the Agile model is with the end goal that there are sub cycles for each stage and every one of those stages have a fixed end date for emphasis. Though, for Incremental Iterative models, the emphasis proceeds until the framework advancement isn't acceptably finished.

There are a few mainstream ways to deal with coordinated improvement, including extraordinary programming (XP), Scrum and Dynamic frameworks advancement strategy (DSDM). [7] Extreme Programming procedure is useful when there are continually changing requests or prerequisites from the clients or when they don't know about the usefulness of the framework. It advocates visit "discharges" of the item in short advancement cycles, which characteristically improves the efficiency of the framework and furthermore presents a checkpoint where any client prerequisites can be effectively executed. [8] Scrum has a few likenesses with XP, including little groups, a progression of cycles (called prints , and an emphasis on building the framework each little piece in turn. Scrum groups acquire necessities toward the beginning of a task or a dash, at that point self-arrange and structure excesses containing their arranged way to deal with the undertaking. [9] DSDM is a Rapid Application Development (RAD) way to deal with programming advancement and gives a deft task conveyance structure. The significant part of DSDM is that the clients are required to be included effectively, and the groups are enabled to decide. [10]

It requires extraordinary aptitude to comprehend these techniques and to execute them. Agile model is moderately new in the business but since it gives reasonable methodology, it is generally utilized. Client criticism is the foundation of Agile. Agile is most appropriate for ventures with evolving necessities.

3.4 Rapid Application Development Model

RAP model depends on prototyping and iterative improvement with no particular arranging included. [11] This model has moderately shorter improvement cycles. Fast Application Development (RAD) model has the accompanying stages −

- Requirements Planning stage − In the necessities arranging stage, workshop should be directed to talk about business issues in an organized way.
- User Description stage − In the User Description stage, robotized devices are utilized to catch data from clients.
- Development stage − In the Construction stage, profitability devices, for example, code generators, screen generators, and so forth are utilized inside a period box, with a "Do until Done" approach.
- Cut Over stage − In the Cut over stage, establishment of the framework, client acknowledgment testing and client preparing are performed

RAD model is centered around clients to such an extent that there are emphases among the User Design and Construction stages. Models are assembled, at that point tried and dependent on the criticism they are refined once more. This can some of the time drive the engineers to concentrate too intently on the convenience viewpoint instead of concentrating on building the framework. The arranging stages use lesser time and more accentuation is given to prototyping and testing. This permits venture administrators and partners to precisely quantify advance and impart continuously on developing issues or changes. [12] The RAD approach varies from customary strategy by clinging to a severe deadline. For the fruitful undertaking processment, all partners ought to be ready for the course of events. [12]

3.5 Justification

While choosing philosophy for our project, we considered factors like information on user requirements, commonality with innovation, unpredictability of methodology and time span. We believe it's ideal in the event that we embrace the "Incremental Iterative Development Model". Steady Iterative model accentuation on investigation, structure and usage stages which we believe are the territories we have to center for our venture.

We made some intense memories choosing between the RAD model and Incremental Iterative, but since RAD has a significant number of customer side contributions, and at present we don't have a particular customer, we thought of dropping the RAD model. In addition, the need to build up the framework arrangement in a shorter interim of time. Cascade innovation would be too conventional to even consider justifying answers for our concern articulation. There is no client association in the model, which we believe is the greatest disadvantage. In the event that the necessities changes anytime of the cycle, returning to the prerequisites examination stage would be bulky. We were captivated by Agile technique yet after cautiously understanding the model we calculated that we came up short on the aptitude to utilize it appropriately.

IV. Requirements Summary

Requirements of a system is defined as what characteristics a system needs to have or what it must do. In the Analysis phase we gather the requirements and the process is to determine the basic requirements for the system by conducting basic analysis by

- Understanding the system's situation where we are dealing with the grocery mart we need to analyze from every point of view as a customer as well as the seller. They are various perspectives of those requirements.
- Making sure that we are not deviating from the main requirements and selecting necessary and important requirements
- Ensuring that those requirements have constraints which can be achieved and capture the main functions.
- Measuring the services and the implementation of the requirements by often mapping the work achieved by it and by recognizing those functions.
- Setting a method to monitor the performance of those requirements and setting standards which determine the quality and quantitative levels of their acceptability.

We can identify and interpret these requirements by a simple process

1. Identifying the key people who are directly related to the project and will be affected by it : The grocery mart needs which includes the people who supply the food ,the staff who manage the inventory products and check on it , people who check up on the inventory, the people who deliver the products and people who trash the waste. Discussing the scope of the requirements and identifying the solution will help us meet the requirements of the users thus including them in this too.
2. Documenting these Requirements: By interviewing the above-mentioned people who are also called stakeholders allows us to understand their opinions on specific needs because every person involved considers the project from their perspective and can also conduct workshops or joint interviews for discussing the information and detailed specifications. Even the use cases help us understand the whole process in a detailed manner by drawing use case diagrams and by building prototypes which will give us ideas of what our end product will look like and address the inconsistencies, feasibility issues and problems.
3. Categorizing the requirements: This step includes various perspectives and they include
    - Technical Requirements: They define the issues and problems related to IT/Technical field and these play an important role in the inventory management for determining and updating the stock and the list of products.
    - Operational Requirements: These are the requirements which are related to the operations like the supply logistics which function in the background to keep the items in stock and functioning.
    - User Requirements: These are the specific demands and the necessities of a user which they need. Suppose there are certain products which are in high demand so they need to be kept on stock frequently which needs constant supervision.
    - Business Requirements: They define the solutions which can lead to making profits and shares leading to the growth of the business.
    - Transitional Requirements: They are the necessary actions or steps which is required to implement new items like changes in the process or the product and make that process run without any obstacles

- Functional and Non-Functional Requirements: These functional requirements define how a system should function like the behavior of a system from a user perspective and a non-functional requirement defines the operations of a system.

Feasibility analysis: Finally, after we gather and categorize all these requirements we need to learn how to achieve them and how to make our system deliver these requirements. We need to make sure that we list the requirements clearly which means they do not cause any confusion or vagueness. They need to be analyzed in a manner that everything is detailed and known in case there is any problem. Making sure they stick to the business needs and do not deviate.

Effectiveness: It's better to prioritize the requirements in an order of the most important ones within the budget and separate the critical ones and identify them early. Making sure that the consequences of the project are well understood, and the existing process and people will not be affected by it.

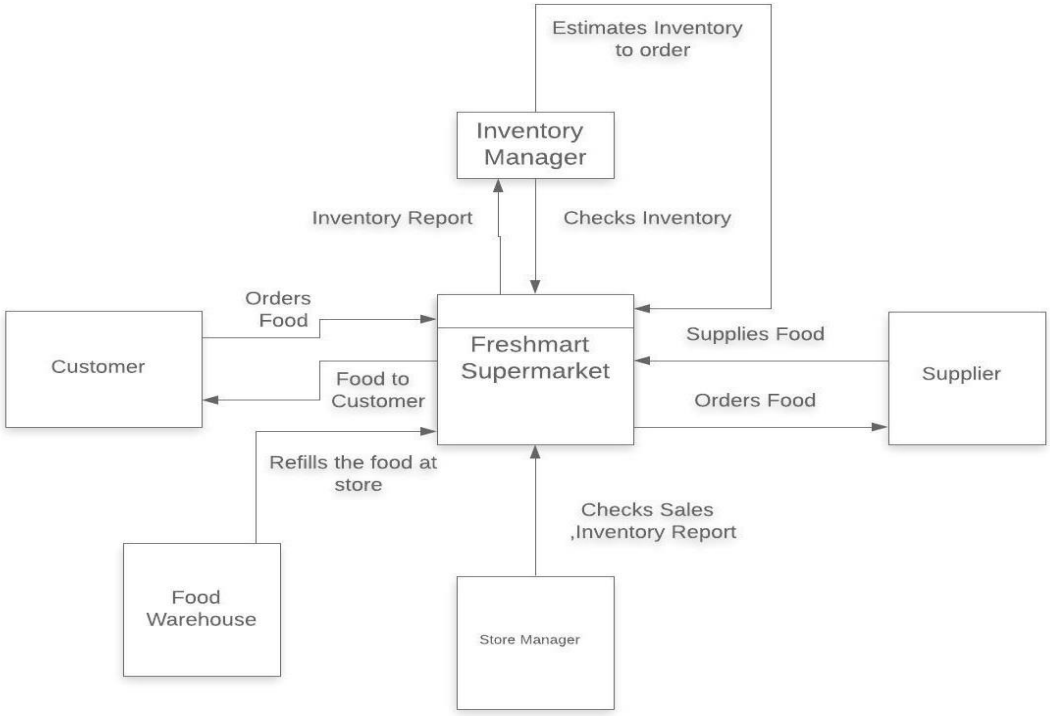
Conflict Resolution: If any conflicts are to arise then they should be resolved by collectively meeting and discussing the issues in the requirements which increases the future scope of the project. Analyze and check the reliability by checking with the stakeholders and participate and conduct peer feedback and review upon it. When there is a conflict regarding a requirement between two stakeholders this solution will be helpful.

In the end, the requirements should be made to get signed by the key stakeholders as a part of the agreement that they are according and in compliance with their needs and ensuring that the project will not get into the scope creep in future.

Elimination of Requirements

Once we determine the scope of the project, we know the current scenario and decide to collect more data by conducting interviews and discussing with stakeholders and conducting surveys. To avoid complications in our system we should concentrate only on reliable and simple sources to collect our requirements. Those requirements should be 99% accurate. When we follow these measures, we can expand the project in the future by eliminating complex requirements which can be replaced or omitted from the project.

V. Context Diagram



Context Diagram

The aim of the project is to reduce the wastage of products by supermarkets along with continually maintaining the availability of fresh and good quality products. Food wastage has significant consequences in the present world. The massive food wastage is because of the following reasons: overproduction, spoilage and expiry. The consequences are been faced by the supermarket chains as they see loss in their business because the products have not been sold and had to be thrown away as they have expired or they are overpriced .Inventory Manager and Store Manager plays important role in maintaining proper inventory and estimating the inventory. Proper food estimation will lead to less or no wastage of food. Estimation can be done by analyzing the sales report, inventory report for a period of around 1-2 months. From this above data the store manager and inventory manager can get the rough estimation on the stock of the food supplies to order and keep in stock. There are also third-party apps that will help to predict the volume of food available where there is a specified number of individuals. We didn't have such third-party software because we felt it was the duty of event planning to provide the knowledge to the system.

Inventory is like the grocery production room. The quantity of food needed may be determined according to sales data, inventory report and food left in the warehouse. Analyzing the data over a period can provide some close estimation which will help to reduce the wastegate of food at supermarket. Holding a hold of this data over time will help create conclusions on food needs as well. Thus, maintaining a proper stock on

basics of sales data will lead to no food wastage and also will help the supermarket profit to grow due no food wastage. Food wastage and income from business will go hand in hand because they rely on one another. If the product is not lost and delivered during a short amount of time, the business does not suffer any loss, so the business does have to recover the product adequately after the festive season and during holidays in order to earn extra profit.

VI. Requirements

a. Functional Requirements

The Functional requirements provide us with the core functionality of the designed application. They define how certain parts of the system should function and these functions can be described as specifications of behavior between various inputs and outputs. Also, functional requirements are used to outline the essential actions that the system must be able to perform. The following functional requirements have been determined as important to Managing Grocery Inventory/Supply & Demand information system:

1) Verification:

User verification is a very essential part of the overall system, in order to allow any user access to mobile applications. For instance, after multiple failed login attempts by any individual user, the system will automatically send an alert (i.e. a security report) to the system administrators. The security administrator can use the security report to make changes to the parameters used for user verification.

2) User Identification:

The system must set forth several user profiles or identities. These user profiles or identities will limit the amount of content being shown to the user. For example, some of the user profiles or identities could be: system administrator (who has access to the whole system – i.e. full access), vendors (who will have limited access to the system but more than the end user) and lastly the consumer or end user (who will have the most limited access to the system).

3) Quick reference guide:

When the user logins into the application for the first time after setting up the account, the application will have a pop-up prompt that will work through how to use the application/system.

4) Password recovery:

In case, the user forgets or after several failed login attempts, the application should allow for password recovery. The system will automatically send an email to the user's registered email address to reset the password.

5) User Account recovery:

Like the password recovery, if the user forgets their username/ID. The system will send a link to the registered email with the username.

6) Security Questions:

When creating an account, the system will ask several security questions. These security questions will help the user in recovering account information (i.e. username and/or password).

7) Barcode scanning:

Inventory management software integrates with barcode scanners for instant product identification and labelling. This helps in easily identifying and tracking your products

8) Inventory optimization:

Maintaining just the right amount of inventory for each product, without over- or under-stocking any item is really important. As the products experience a seasonal rise and fall in demand, this feature will display how much quantity of each product is in stock, which will make it easy to order/not to re-order that product.

9) Stock notifications:

When there's over or under-stocking beyond a defined threshold the user will receive alerts and notifications. This helps the user to place orders or offer promotional discounts to clear out extra stock.

10) Report generation:

This enables the user to view sales history in the form of a list of the most popular products. This feature also enables you to manage items in your inventory that have not reached the sales levels you expected, for example, by offering discounts on them.

11) Multi-Location management:

Manage multiple warehouses and points-of-sale (POS) will be done using this feature. All locations can be integrated within a single inventory management system.

12) Material grouping:

By grouping inventory into predefined categories, it is ensured that the user is always updated about quantities of components and specifications that make up the product stock, and manage their reordering schedules as required.

13) Warehouse management:

This feature is useful if there is a need to optimize warehouse stock and maintain an accurate log of each product's location. It'll give the user a single view of where all the products are stored.

14) Logout option:

Just as login into the app is important, the ability to logout of the system is also critical. There are several options that can be implemented to log out a user. The most noticeable option would be providing "a logout button" to enable users to logout from any page. Another option could be once the user closes the application; this will automatically log out the user.

15) Session logout:

If there is no user activity for more than 10 minutes, the system should automatically logout the user account terminating the session. A pop-out alert will ask if the user is still there before logging out of the user account.

16) Preserving active orders:

Should the user accidently close out the application, the system should be set up to save any active orders in the system. So, the next time, the user logs back in, they will be taken back to the previous page.

17) Feedback/Survey:

After regularly using the mobile application, the system should generate a feedback survey pop-up. This will allow the user to send any feedback to the system administrators or application developers (i.e. regarding the application, the overall service and other issues/concerns they might have).

b. Non-Functional Requirements

Non-functional requirements are the characteristics or properties the product must possess, as they directly or indirectly supplement the product's success. Non-functional requirements are proven to play a vital role in the success of the product/system. Unaccomplished execution of the non-functional requirements shall lead to unsatisfied users. Determining whether a requirement is functional or non-functional is often a critical and debatable aspect.

Usability:

Usability defines how difficult it will be for a user to learn and operate the system. Usability can be assessed from different points of view:

Efficiency of use: the average time it takes to accomplish a user's goals, how many tasks a user can complete without any help, the number of transactions completed without errors, etc.

Intuitiveness: how simple it is to understand the interface, buttons, headings, etc.

Low perceived workload: how many attempts are needed by users to accomplish a task.

The five non-functional requirements under Usability are:

1) When the user first opens the application the default page shall display the application logo and the name.

2) When users are moving to the next page for further action, all the pages by default shall contain the application's logo.

3) Developing Responsive pages which automatically adapt to the user's device. This eliminates the temporary malfunction that occurs in the application while shifting from one device to another device with respect to the users.

4) Implementing Language Adaptability, to let the user access the application in their respective preferable language. The most common languages used with respect to the region/location of the user can be initiated in the application. Hence, increasing the ease of usability of application among diversified users.

5) Allowing multiple users to navigate through the application simultaneously and efficiently.

Privacy:

1) Authenticated and Authorized access to users accounts through passwords, face ids. No user shall order without creating an account or logging in.

2) Malicious software ads shall be restricted while users access the application on an online web platform.

3) Inventory details should be visible only to the user who has the authority and to the system and security administrators.

4) Data sources constituting the track of ingredients inflow and outflow should be kept in private and outflow of the information is only possible if the information requestors abide by the privacy preserving rules.

5) Data source or log consisting of user's information (login credentials, personal information or any such important details) shall have restricted access abiding to the privacy rules of the Grocery Inventory/Supply & Demand system and shall maintain data integrity.

Performance:

1) Response time is the time taken by the application to reciprocate and respond to the actions the user has chosen. Response time shall not exceed more than 15 seconds while users perform actions.

2) Grocery Inventory/Supply & Demand information system shall approximately support 10,000 users at a given point of time.

3) The system must not lag, because the workers using it don't have down-time to wait for it to complete an action.

4) Throughput time is considered as the time taken to process the users request. The throughput should not exceed 5 seconds.

5) Data sources or databases mainly for maintaining storage capacity should consist of cache. This makes the data/users information's retrieval easy and reduces users retyping their login information.

Security:

Security requirements ensure that the software is protected from unauthorized access to the system and its stored data. It considers different levels of authorization and authentication across different users' roles. Security also includes protection against viruses and malware attacks.

1) Minimization of page reload errors when the users are using the system.

2) Notifying the users about security issues of their respective account information and payment details.

3) Maintaining and securing the Software Infrastructure without the intervention of individuals who do not belong to the inventory system.

Maintainability:

Complete monitoring of the application will always be on the action so that the users will not face any server breakdown. An authorized person will monitor the actions of the user on the server and to guide them while using the application. If the user raises a defect, the administrator should direct the defect to the concerning team to take the action.

Legal:

The software must be licensed on an individual basis for smaller companies, as well as through a multi-license deal for larger corporations. The client should agree to End User License Agreement (EULA) before using this software.

Supportability:

The software is designed such that it works even on systems having the minimum configuration. The system is adaptable even if additional plugins or modules are added at a later point. The data can be exported to the manager to make the system more portable.

Data Integrity:

To store many user profiles with their personal information, there should be a huge amount of data storage options in the server. Therefore, adding datastores to the system will be a helpful option. Upon that, the verified and previous history on each should be stored in the backup so that the user can pull the history of data whenever they want to access it.

VII Project Plan

The aim of the project is to reduce the wastage of products by supermarkets along with continually maintaining the availability of fresh and good quality products. Proper design of a project plan is necessary for successful completion of the project. A good project plan will provide the correct estimate for the resources required to complete the project. The entire project will be divided into following phases: Planning, Analysis, Design, Implementation and Maintenance. Waterfall process model will be used for this project. One phase is completed before moving to another, starting from the planning phase.[29]

a. Planning Phase

In this phase a set of plans are created which will help in delivering the project on time. Proper planning will help to manage time, cost, quality and issues in the project. We will do a feasibility analysis and resource analysis to ensure the completion of the project. A roadmap will be created which will guide us throughout the project. The goal is to increase the sales and maintain profits, which will be the focus of the planning phase.

b. Analysis Phase

In this phase we will do requirements analysis of the given problem. The given system will be studied and analyzed carefully to derive the requirements keeping the goal of the system in mind. The available data from the stores is studied, to determine the sales, quantity and availability of products. The requirements for the software to be developed are determined and need to be approved by the product owner. This phase is very important as correct requirements are essential for successful delivering of the final system.

c. Design Phase

After the analysis phase, and final approval of the desired features of the system, we will be designing the system. The system and product will be designed. Different types of UML diagrams will be used to demonstrate the design of the system based on the requirements derived from the previous phase. Once approved the design will be used in the next implementation phase. Use case diagrams will be used to display the different actors and use cases involved. Class Diagrams will

be used to define the structure of the system. Component diagrams will define the different components involved in the system.

d. Implementation Phase & Maintenance Phase

The diagrams from the design form the backbone of the implementation phase. The final implementation will begin in this phase. Different components of the system will be developed and tested individually, then integrated together and integration testing of the system will be done. Any modification in the requirements will need a modification in the implementation, so the program will be developed to handle the change in requirements. Once the system is developed, usability of the system will be tested to determine whether the system confirms to the requirements. After implementation, maintenance of the system is equally important. Any necessary improvements and changes will be made to the system to ensure that the system continues to work and is updated with the business requirements of the user.

e. Project Plan

After the completion and testing of all the above phases the product will be released. All the phases will be approved by the project manager and leaders associated with the project. The Flow of the project will be based on a project plan approved by the project manager.

Task	**Task Assigned** (Team Manager)	**Start Date**	**End Date**	**Estimated Time**	**Task Update**
Planning	DK Bose	02/15/2020	03/30/2020	45 Days	Done
Analysis & Requirements	James Henry	03/31/2020	05/30/2020	60 Days	Working
Design	John Kim	06/01/2020	08/01/2020	60 Days	Not Done
Implementation	Katrina Kaif	08/02/2020	10/02/2020	60 Days	Not Done
Maintenance	Dhoni	10/03/2020	11/03/2020	30 Days	Not Done

Project Work Plan[29]

Task Description	**Start Time**	**End Time**	**Estimated Time**	**Task Update**
Planning Phase	**02/15/2020 – 03/30/2020**			
Project Identification	02/15/2020	02/22/2020	7 Days	Done
Feasibility Analysis	02/23/2020	03/05/2020	10 Days	Done
Resources for Project	03/06/2020	03/15/2020	9 Days	Done
Methodology Selection	03/16/2020	03/23/2020	7 Days	Done
Documentation	03/24/2020	03/30/2020	6 Days	Done
Analysis & Requirements Phase	**03/31/2020 – 05/30/2020**			
Analysis Strategy	03/31/2020	04/10/2020	10 Days	Pending

Requirements Analysis	04/11/2020	04/25/2020	20 Days	Pending
Use Case Design	04/26/2020	05/05/2020	9 Days	Pending
Model Processing	05/06/2020	05/21/2020	15 Days	Pending
Documentation	05/22/2020	05/30/2020	8 Days	Pending
Design Phase	**06/01/2020 – 08/01/2020**			
Physical Design	06/01/2020	06/15/2020	15 Days	Pending
Architecture Design	06/16/2020	06/25/2020	10 Days	Pending
Interface Designing	06/26/2020	07/06/2020	10 Days	Pending
Program & Database Structure	07/07/2020	07/25/2020	18 Days	Pending
Documentation	07/26/2020	08/01/2020	5 Days	Pending
Implementation Phase	**08/02/2020 - 10/02/2020**			
System Configuration Setup	08/02/2020	08/12/2020	10 Days	Pending

System Installation	08/13/2020	08/18/2020	5 Days	Pending
Maintain System	08/19/2020	09/01/2020	12 Days	Pending
Testing	09/02/2020	09/17/2020	15 Days	Pending
System Release	09/18/2020	10/02/2020	15 Days	Pending
Maintenance Phase	**11/03/2020 – 11/03/2020**			
Maintenance	10/03/2022	11/03/2022	30 Days	Pending

Project Task Planning [29]

f. Staffing for Project

The working and completion of a project requires both operational and technical skills. Total 10 people with different experience are working on each phases to complete the project. Out of 10 members, one is project manager with 5 years experience of project management. Operations Lead has 6 years of experience. Technical Lead has 7 years of experience and 2 analysts with experience with 2 years and 4 years are working on the project. 2 application developers and 2 system engineers with experience more than 2 years and 2 backend developers with experience more than 3 years are working on the project. The summary of complete staff with job role and experience is mentioned in the below mentioned table. [29]

Job Role	**Employee Name**	**Job Experience**	**Reporting Manager**
Project Manager	Arjun Kumar	5 years	Leaders
Operations Lead	James KK	6 years	Project Manager

Technical Lead	Harbhajan Singh	7 years	Project Manager
Analyst	MS Goni	4 years	Technical Lead
Analyst	Kareena Kapoor	2 years	Technical Lead
Application Developer	Salman Khan	3 year	Technical Lead
Application Developer	Narendra Modi	2Years	Technical Lead
Backend Developer	Amit Shah	5 Years	Technical Lead
Backend Developer	Lisa Haden	1 Years	Technical Lead
System Engineer	Deol	2 Years	Technical Lead
System Engineer	Sunny	1 Years	Technical Lead

Staffing Table

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