**Fooder**

**Project Plan**

**Prepared by:**  **FOD Project Management Solution, Inc.**

**Issue date:**  **21 October 2019**

**Version:** **1.0**

**Revision Control**

*This section serves to control the development and distribution of revisions to the project plan. It should be used together with a change management process and a document management system. It is recommended that changes to the project plan be documented only by adding appendices to the original project charter. This will keep an accurate history of the original document that was first approved.*

| **Revision Number** | **Date** | **Description of Changes** | **Author/Editor** | **Communication of Change** |
| --- | --- | --- | --- | --- |
| 1.0 | 21-oct-19 | Initial draft | FOD |  |
| 1.1 | 25-nov-19 | Modified draft | FOD |  |
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# Project Overview

## Project Summary / Business Justification

The purpose of this project is to provide personal health monitoring services with a complete energy intake system which will be available to healthcare providers or individuals at competitive prices. The product will be available to all users with a mobile device, and is convenient to use for both beginners and experienced users who want to stay fit.

The product offers an automated and enhanced method of tracking nutritional information in a meal. It allows for a more convenient and affordable method for logging food intake. This product can be compared to current existing applications that require manual measurements and inputs of food. Manual food logging applications require users to measure each individual ingredient, which results in a very time-consuming process. This decreases the ease of use for food logging, and would be particularly more difficult for beginners.

We have defined the deliverables/milestones, and the target deadlines for each. The software development process of our application aims to follow closely with the deadlines defined, while staying on budget. Our end product must satisfy all of the requirements written during our design phase, and pass 100% of our test suites. Criteria for success includes providing scheduled deliverables and meeting target completion/progress dates per the project charter, in addition to the implementation of an accurate algorithm in both food identification and calorie calculation.

# Goals, Objectives, Scope

# Goals / Objectives

Build an app that can calculate people’s calorie intake by processing the pictures of their food on a daily basis:

* An image processing algorithm that can successfully identify all visible ingredients in a photo with a 94.12% success rate.
* An algorithm is written using machine learning technology
* AWS cloud services to store large amounts of data of all users
* Application is available and compatible with the latest versions of Android and iOS
* Have a functional product available for user testing.

# Scope

In this project we will be developing a cross platform mobile application, allowing the user to take pictures of their food and automatically calculates the caloric and nutritional information of that picture with high accuracy. In the picture no external references are required. The computational time should be reasonable. It should be available 24/7. The platform should utilize Amazon webservices, we store the pictures for research only. The final project must be delivered on budged and on time. The project is only in a mobile version, not a website. The ownership of the end product belongs to Digital Health Inc., the people who is evolved in the project own any part of the project. We don’t ask for personal information. All personal during the development of the project should not disclose information, except within the company.

# Assumptions and Constraints

## Assumptions

This project is based on the following assumptions

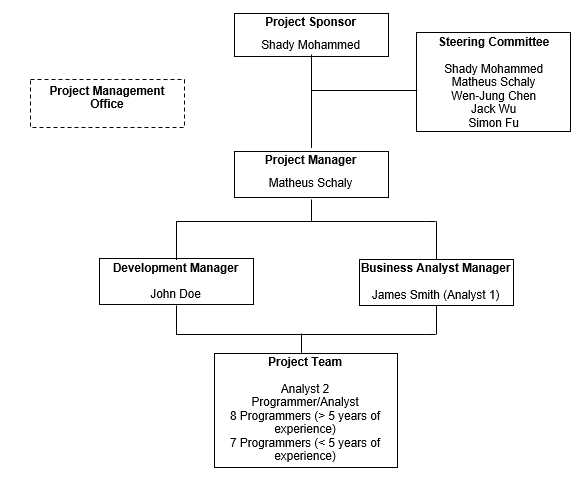
* All project team members will be available during the project time frame.
* Funding is available once project is started.
* Project has executive-level support and backing.
* Project team will successfully manage to produce deliverables within scope, budget, and project schedule.
* Initial roles of team members are not fixated throughout the project time frame.

# Constraints

The app must achieve high accuracy in both food identification and calorie calculation. It has to be easy to use and pleasant. Moreover, the app must detect each food ingredient that is visually detectable. It must also use auto-calibration techniques, it should not use external objects in the image. Furthermore, the app must be highly scalable, it must use Amazon Cloud. It must also use Artificial Intelligence (AI) for food detection. The AI training should be incremental and no re-train itself when every new picture is uploaded. The app should run on both Android and iOS.

# Project Organization

## Organizational Structure



## Roles and Responsibilities

|  |  |
| --- | --- |
| **Role** | **Responsibilities** |
| **Project Sponsor** | - Has ultimate authority over and is responsible for a project  - Approves changes to the scope and provides whatever additional funds those changes require  - Approves deliverables. |
| **Project Manager** | - Has authority over and is responsible for a project  - Is responsible for the project charter and project plans  - Manages the project within the terms of the project charter  - Is responsible for the project management and control structure  - Is responsible for coordinating the efforts of the project team  - Plans, organizes and controls the development of all project deliverables, etc. |
| **Steering Committee** | - Provides high-level guidance and direction on key issues such as company policy and objectives, budgetary control, marketing strategy, resource allocation, and decisions involving large expenditures  - Assists in developing the project charter and project plans  - Helps resolve issues and change request |
| **Development Manager** | - Controls the technical aspects of the project  - Controls the day-to-day aspects of the project  - Develops and maintains project charter and project plans  - Executes formal reviews and management reviews.  - Tracks and disposes of issues  - Helps resolve issues and change request  - Tracks action items and budgets  - Is responsible for the technical and functional quality of the solution |
| **Business Analyst Manager** | - Controls the business aspects of the project  - Participates in day-to-day business program activities  - Assists in developing the project charter and project plans  - Approves business program deliverables, resolves conflicts over the policy or objectives  - Disposes of issues and change requests  - Assists in tracking action items and budgets |
| **Users** | - Uses the final products  - Reports bugs and problems  - Provides suggestions  - Requests new features |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Role & Responsibilities / Deliverable** | **Project**  **Manager** | **Business** **Analyst**  **Manager** | **Development Manager** | **Business Users** | **Project** **Sponsor** | **Steering Committee** |
| Create Project Charter | R,A | I | I | C | C | C |
| Fund Project | I |  |  |  | R,A | C |
| Document Requirements | C,A | R | C | C | C | C |
| Project Plan | R,A | C | C | C | I | C |
| Communication Plan | R,A | C | C | I | C | C |
| System Design | C | C | R |  | C | C |
| Test Plan | C | C | R |  | I | C |
| Customer Acceptance | R | C | C |  | C | C |
| Product Deployment/  Project Completion | R | C | C | I | C | C |

**R - R**esponsible (the doer)

**A – A**ccountable (the buck stops here)

**C – C**onsult (In the loop – two way communication)

**I – I**nform (Keep in the picture – one way communication)

# Managerial Process Plans

# Start-up plan

This section provides an overview of the resources needed to initiate the project and includes the following sections: estimation plan, staffing plan, resource acquisition plan, and training plan.

# Work plan

This clause specifies the work activities, schedule, resources, and budget details for the software project. The work breakdown structure (WBS) is attached to the document.

# Work activities

The attached WBS depicts the work activities and the relationships among work activities, including their dependencies. The WBS describes the resource requirements and schedule duration for each work activity. Work packages are used to specify, for each work activity, factors such as necessary resources, estimated duration, and predecessor and successor work activities.

# Schedule allocation

The WBS provides the scheduling relationships among work activities in a manner that depicts the time-sequencing constraints and illustrates opportunities for concurrent work activities. Furthermore, the by using the WBS, we can create the Gantt chart, which provides the critical path of the project.

# Resource allocation

Resources include the numbers and required skill levels of personnel for the project. The WBS makes clearer the necessity for the project managers, developer manager, business analysts and the programmers needed to complete some of the tasks. Even though most of the cost goes to the programmers, most of the effort and schedule is dedicated to the planning of the project.

The size of the project, 9.941 KLOC, is given by function points, where the adjusted functions points were 187.58. The programming language that is going to be used is Java. Then, to calculate staff-months and months, COCOMO intermediate using embedded mode was used. The result was 563 staff-months and 19 months to complete the project. We would need 30 employees in our team to make achieve that. However, as we don’t have access to more employees and our team is composed by 23 people. Therefore, considering 23 people and 563 staff-months, the number of months had to be increased to 24 months. The project is going to take place from 01-dec-2019 to 01-dec-2021.

The table below lists the 23 people that are needed to develop the project. The total cost with personnel is estimated to be around C$ 3,139,552,36.

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Proposed Person** | **Dates Required**  **(From – To)** | **Anticipated Hours** |
| Developer manager | John, Doe | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Business Analyst 1 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Business Analyst 2 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Analyst | James, Smith | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Experienced Prog. 1 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Experienced Prog. 2 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Experienced Prog. 3 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Experienced Prog. 4 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Experienced Prog. 5 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Experienced Prog. 6 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Experienced Prog. 7 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Experienced Prog. 8 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Unexperienced Prog. 1 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Unexperienced Prog. 2 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Unexperienced Prog. 3 | To be determined | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Unexperienced Prog. 4 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Unexperienced Prog. 5 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Unexperienced Prog. 6 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Unexperienced Prog. 7 | To be determined | 01-jan-2020 to 01-dec-2021 | 3,832 |
| Project Manager 1 | Matheus, Schaly | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Project Manager 2 | Wen-Jung, Chen | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Project Manager 3 | Jack, Wu | 01-dec-2019 to 01-dec-2021 | 3,992 |
| Project Manager 4 | Simon, Fu | 01-dec-2019 to 01-dec-2021 | 3,992 |

# Budget allocation

The activity budget includes the estimated cost for activity personnel, computing resources and software tools. Based on the WBS, we can notice the number of personnel needed, as well as their skills. The computing resources cost is related to the price of the notebooks needed for the project. Software includes the anti-virus and designing tools. There is no need for travels or differential meetings. The meetings budget is already included in the labor budget. Furthermore, according to the WBS, we need the contracted services from Amazon in order to store our dataset and run our machine learning algorithm. The following table provides an estimate of the cost to complete the project.

The labor costs were calculated based on [2]. We have in our disposal the following software developers: 2 entry-level, 5 early-career, 5 mid-career, 1 experience and 2 late-career. The entry-level receives C$ 22,00/hour, early-career C$ 22,49/hour, mid-career C$ 35,57/hour, experience C$ 65,00/hour and late-career C$ 59,00/hour. Moreover, we have 1 late-career programmer analyst which receives C$ 50.05/hour; 2 late-career programmer analyst which receives C$ 50.05/hour; 1 late-career senior software engineer which receives C$ 61.92/hour; and 4 entry-level project managers in software development which receives C$ 20.59/hour. Based on the number of hours on the table above and the individual salaries, we get a final cost of C$ 3,139,552.36.

The hardware cost is the cost of buying 19 Acer Aspire 5 15.6" Laptop, Core i5 8265U, Intel HD Graphics 620, A515-52-58JD with a cost per unit of C$ 750.00.

The software cost includes 1 Norton 360 Platinum Plus I for 20 users with a cost of C$ 160,00 per year and 23 Edraw Max tools, to facilitate building diagrams, with a cost of 89.95 each.

Finally, the contracted services are related to the Amazon Machine Learning where the monthly price for Amazon LM batch predictions is $ 0.10 per 1000 predictions, which would need to be added the compute and predication fee.

|  |  |
| --- | --- |
| **Resource Type Expenditure** | **Total Project Costs** |
| Labour | C$ 3,139,552.36 |
| Hardware | C$ 14,250.00 |
| Software | C$ 2,548.85 |
| Contracted Services | C$ 2,824.60 |
| Contingency | C$ 399,787.25 |
| **Cost to Complete** | **C$ 3,498,963.06** |

# Deliverables / Milestones

|  |  |  |  |
| --- | --- | --- | --- |
| **Deliverable / Milestones Name** | **Description** | **Target Date** | **Responsibility** |
| Project Charter | Discusses the overall outlook on the project | 27-sep-2019 | Project Manager |
| Technical Requirements Document | Outlines the features and intended behavior of a software application | 21-oct-2019 | Development Manager |
| Project Plan | Guides the control and execution of a project | 25-nov-2019 | Project Manager |
| Communication Plan | Sets clear guidelines for how information will be shared with client, team and other stakeholders. | 25-dec-2019 | Project Manager |
| System Design | Defines the architecture, modules, interfaces, and data for a system to satisfy specified requirements. | 4-feb-2020 | Development Manager |
| Test Plan | Describes software testing scope and activities. | 4-apr-2020 | Development Manager |
| Customer Acceptance | Executes formal testing with the customer | 1-aug-2021 | Project Manager |
| Product Deployment & Project Completion | Ends the project development life cycle | 1-dec-2021 | Project Manager |

# Development Methodology

The development methodology of our project is the Iterative and Incremental (I&I) development. I&I is modeled this method of software development that is modeled around a gradual increase in feature additions and a cyclical release and upgrade pattern. Moreover, I&I begins with planning and continues through iterative development cycles involving continuous user feedback and the incremental addition of features concluding with the deployment of completed software at the end of each cycle. The programming language of our project is the Java programming language [1]. The tools to be used to specify, design, build, test, integrate, document, deliver, modify and maintain the project deliverable and non-deliverable work products include the WBS Schedule pro, StarUML, Git, GitHub and/or any other tool already being used by the Digital Health Inc. team. To accelerate the development process, the technical standards, policies, and procedures governing development and/or modification of the work products should be the same already being applied by the developers of Digital Health Inc. The standardization and measurement control of Digital Health Inc. should be applied during the software development process.

# Start-Up Plan

This section provides an overview of the resources needed to initiate the project and includes the following sections: estimation plan, staffing plan, resource acquisition plan, and training plan.

# Estimation

Our basis of estimation will include local history. The reason for this is because we will be using the previous local history to estimate costs and scheduling. Data related to local history will be provided by Digital Health Inc. who have previously attempted to build the application in the past. An estimated cost of approximately four million dollars will be needed to conduct the project. With this budget, we defined 8 stages/milestones along with its target dates. We will reuse the initial method and tools for estimation when we perform our periodical re-estimations. Using the same methods will allow for more accurate comparisons between the two values and the factors that may have affected the differences. Due to the use of historical data, estimation of size of software, using The Blitz method would be more accurate in comparison to other methods.

# Staffing

Our team consists of a fixed team of twenty-three people that was set during the beginning of the project. Nineteen of the team members will be provided by the company (Digital Health Inc.) which is comprised of Inexperienced and experienced developers, an analyst, two business analysts, and a developer manager; The other four team members are Project Managers. All twenty-three members will be hired for a total of 621 staff-months and 29 months.

# Resource acquisition

For the duration of this project, it is expected that all resources will be available from the beginning of the project until completion. There are no plans to acquire resources for the duration of this project and any form of personnel or production equipment. All team members will be given a workstation, and each member will be responsible for accessing the required software resources on their own. The possibility of any other software or hardware resources needed will need to be approved and provided by the company (Digital Health Inc.)

# Staff Training

There is no specific staff training plan defined for this project. Seven inexperienced developers who are not familiar with the domain will be receiving on-the-job training. Each inexperienced team member is expected to learn and familiarize him or herself in relevant areas of the project. Areas of training can include: iOS and android development, Artificial Intelligence, Machine Learning, Deep Learning, and any other relevant topics.

# Requirements

# Functional Requirements

1. The system shall run on both Android and iOS.
2. Upon the completion of the tutorial, the user shall be able to use up to 85% of functionality.
3. The system must use Amazon Cloud to store its data.
4. The system shall detect each food ingredient that is visually detectable.
5. The system shall calculate the weight of each detected ingredient.
6. The system shall measure the actual dimensions of the food image taken by the user.
7. The system shall use auto-calibration techniques for images uploaded.
8. The system shall allow the user to upload food images stored from their mobile device.
9. The system shall allow the user to edit the food image to be uploaded.
10. The system shall allow the user to visualize the analyzed food information.
11. The system shall allow the user to take a photo of the food.
12. The system shall allow the user to view previously uploaded photos.
13. The system shall allow the user to adjust the estimated weight of ingredients detected.
14. The system shall require the user to have an Internet connected in order to upload photos.
15. The system shall allow the user to upload multiple photos at a time.
16. The system should use artificial intelligence for food detection.
17. The system should only allow access from authorized users.
18. The system shall allow the user to see his current nutrition status.yst

# Non-functional Requirements

1. The software’s accuracy must be at least 94%.
2. The software’s transition time from a black screen to a functional interface should take less than 1 second.
3. The software must allow photos to be uploaded with the extension .jpg and .png
4. The software shall have a maximum file upload size of 100 MB.
5. The software must allow photos with resolutions up to 4K to be uploaded.
6. The system shall be able to handle a growing amount of work by adding resources to the system.
7. The system should achieve at least 99.99% availability.
8. The processing time of the image should be less than 3 seconds.

# Configuration Management

## Versioning

Each release (internal or external) must attached a version number, as well as a snapshot of the software for future rollback.

Decision on version number should reference to [Schema Versioning](https://semver.org/).

## Change Management

When change is introduced from client or staff or external feedbacks, PM will assess its duration, cost and impact on the timeline. Then project manager will discuss with the lead developer to verify their assessment.

Another factor during the priority evaluation is risk, we would give a higher priority to tasks that persist a higher risk level respectively. Because the sooner we address them the faster we can mitigate them with the minimum loss of resources later on.

Once the change is properly evaluated, project manager will decide the introduction of the change. If introduced, that will be closely monitor through the development process, ensure the scope of that change remain within expectations.

## Backtracking

If the change needs to be made is urgent, such as severe bug, or mis configuration of environment. The system will rollback (backtracking) to its stable state.  Then redeploy to its latest state once the bug is resolved and tested.

## Change Control Plan

### Change request process flow requirements

|  |  |
| --- | --- |
| **Step** | **Description** |
| Generate CR | A submitter completes a CR Form and sends the completed form to the Business Analyst Manager |
| Log CR Status | The CR Log is automatically created after the CR form submission. The CR’s status is updated throughout the CR process as needed. |
| Evaluate CR | Project personnel review the CR and provide an estimated level of effort to process, and develop a proposed solution for the suggested change |
| Authorize | Approval to move forward with incorporating the suggested change into the project/product |
| Implement | If approved, make the necessary adjustments to carry out the requested change and communicate CR status to the submitter and other stakeholders |

### Change request from a change management log

|  |  |
| --- | --- |
| **Element** | **Description** |
| Date | The date the CR was created |
| CR# | Generated automatically by the CR form submission system |
| Title | A brief description of the change request |
| Description | Description of the desired change, the impact, or benefits of a change should also be described |
| Submitter | Name of the person completing the CR Form and who can answer questions regarding the suggested change |
| Phone | Phone number of the submitter |
| E-Mail | Email of the submitter |
| Product | The product that the suggested change is for |
| Version | The product version that the suggested change is for |
| Priority | A code that provides a recommended categorization of the urgency of the requested change (High, Medium, Low). Verified by the Business Analyst Manager. |

### Evaluating and authorizing change requests

Change requests are evaluated and assigned one or more of the following change types:

|  |  |
| --- | --- |
| **Type** | **Description** |
| Scope | Change affecting scope |
| Time | Change affecting time |
| Duration | Change affecting duration |
| Cost | Change affecting cost |
| Resources | Change affecting resources |
| Deliverables | Change affecting deliverables |
| Product | Change affecting product |
| Processes | Change affecting process |
| Quality | Change affecting quality |

Change requests are evaluated and assigned one of the following status types:

|  |  |
| --- | --- |
| **Status** | **Description** |
| Open | Entered/Open but not yet approved or assigned |
| Work in Progress | CR approved, assigned, and work is progressing |
| In Review | CR work is completed and in final review prior to testing |
| Testing | CR work has been reviewed and is being tested |
| Closed | CR work is complete, has passed all tests, and updates have been released. |

### Change control board

A Change Control Board has power and assists in approving or rejecting changes to the project baselines.

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Name** | **Contact** | **Description** |
| Project Sponsor | Shady Mohammed |  | Approves changes to the scope and provides whatever additional funds those changes require |
| Project Manager | Matheus Schaly |  | Approves all changes except scope |
| Business Analyst Manager | James Smith |  | Helps resolve issues and change request. Follows up the change requests. |
| Development Manager | John Doe |  | Helps resolve issues and change request |
| Steering Committee | Shady Mohammed,  Matheus Schaly,  Wen-Jung Chen,  Jack Wu,  Simon Fu |  | Helps resolve issues and change request |

### Change requests responsibilities

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Name** | **Contact** | **Description** |
| Business Analyst Manager | James Smith |  | Informs project manager about change requests. Helps resolve issues and change request. Follows up the change requests. |
| Project Manager | Matheus Schaly |  | Approves all changes except scope |
| Project Sponsor | Shady Mohammed |  | Approves changes to the scope and provides whatever additional funds those changes require |

# Risk Management

Risk are identified by closely monitoring matrix throughout the project development timeline. With specific emphases on the items listed at 11.1.

Furthermore, once we identified the potential risks, we will discuss and come into a consent of its impact and procedures of mitigation (risk resolution plan). If multiple potential risk occurred, we will handle them according to the impact level. As well as take action on the mitigation procedures.

Once the risk is dismissed, we will revise our risk assessment table for any more consequential risk that might take place in the future.

## Initial Risk Assessment

|  |  |  |
| --- | --- | --- |
| **Risk** | **Impact Level** | **Mitigation** |
| Developers may have technical limitations with our platform and technologies. | 2 | Focus on training developers with new technologies and frameworks. |
| External training data set may not be sufficient enough to achieve our target accuracy. | 3 | Acquire extra labeled image training data set from third-party provider. |
| Uncontrollable downtime due to service outage of our network provider. | 5 | Introduce network redundancy into our backend architecture. |
| The camera quality of users’ phones may have a significant impact on result accuracy. | 3 | Include various quality of pictures in the training data set. |

## Risk Management Plan

### Overview

The purpose of the Risk Management Plan is to define how risk are handled during project development, including risk identification, risk analysis, and risk respond.  Which in terms, can minimize potential lost while predicting any unforeseen situation in the future.

Throughout the development of this project, project manager (PM) and development manager (DM) will closely monitor project progress and brainstorm any potential risk continuously. Once the risk is identified, PM and DM will analysis and discuss about its impact and respond measure.

Once the risk has been analyzed and documented correctly, some precautions will take place if applicable, otherwise we will store them for quick reference when that risk surfaced.

### Risk Identification

|  |  |  |
| --- | --- | --- |
| **Actions** | **Responsible personnel(s)** | **Duration** |
| Brainstorming:  (Divided in 3 sessions)   * PM & DM * DM & DT * PM & DM & DT | Project manager (PM)  Development manager (DM)  Development team (DT) | 1 ~ 2 hours each |
| Delphi method:  PM, DM, and core of DT will seat together to discuss each discovery of potential risk. Then come into consensus on the next step of each item. | PM  DM  Core of DT | 2 ~ 5 hours |
| Documentation:  Once consensus is reached, all risks would need to be properly documented for future reference. | PM | Depends on the number of risks discovered |

### Risk Analysis

#### Qualitative Analysis:

After the risk identification phase, PM will move onto qualitative analysis phase.  The purpose of qualitative analysis is to identify and categorize the consequence of potential risks.

Three main aspects must be address during this phase, they are impacts, precautious measures, and method of monitor and measure. The detail of each aspect is listed below.

Identification of Impact is a critical part of qualitative analysis, since risk is a function of probability of occurrence and its consequence. Without properly evaluating the impact of a risk, we would likely to underestimating or overestimation resources needed to address them. Which would result in a unforeseeable threat to the entire project.

On the other hand, precautious measure is a strategy of minimizing uncertainty, preventing risk to surface in this case. Once risk is identified during identification phase, project manager is responsible to research on the possibility of precautious measures. Which then according to its risk level, project manager will implement and address throughout the project duration.

Lastly, method of monitor and measure is a guideline of how to measure and monitor a specific risk, such that project manager can understand the progress and severances before and after deployment of precautious measures.

In conclusion, project management and related personnel would come into consensus about *impacts, precautious measures, method of monitor and measure* for each identified risk. Generally speaking, this analysis process shouldn’t take longer an hour for each risk.

#### Quantitative Analysis:

The purpose of quantitative analysis is to identify effort required to fully address identified risk. Project manager is recommended to be a moderator only, since development team would have more experience and knowledge in this aspect.

Furthermore, effort should be identified with an unit of man-hour for ease of calculation later on.

### Response planning

The objective of response planning is to develop strategies on reducing threats of the overall project. In this case, risks will be address and tackle base on their priority, resources require and activated needed from difference parties.

It’s highly recommended that each identified risk to consist at least one response plan, such that we can minimize the response time when necessary action needs to take place for identified risks.

Number of response strategies are listed below for quick references.

**Negative risk response strategies**:

1. Avoidance: The project is altered to avoid the identified risk.
2. Mitigation: Effort is made to reduce the probability, impact, or both of an identified risk in the project before the risk event occurs.
3. Transference: The risk is assigned to a third party, usually for a fee. The risk still exists, but the responsibility is deflected outside of us.

**Positive risk response strategies:**

1. Exploit: Used in conjunction with positive impacts where the host organization wants to ensure the positive risk definitely happens.
2. Share: Third-party partnerships that include forming risk-sharing partnerships, teams, special-purpose companies, or joint ventures, which can be established with the express purpose of managing opportunities.
3. Enhance: Seeks to facilitate or strengthen the cause of the opportunity, and proactively targeting and reinforcing its trigger conditions, to potentially increase probability.

# Verification and Validation Plan

The Test Plan has been created in order to communicate the test approaches to team members. This document will clearly identify the scope, objectives, approaches and schedule. It describers process and methodologies used to plan, manage and execute testing of software projects within Fooder.

## Scope

This document details the types of tests that will be performed by the project team for the Fooder project.

It’s within the scope to define the testing requirements and providing an integrated view of the project test activities. The project Fooder focus on testing all the functions and external interface of Fooder application (UI) in scope testing. It includes how testing will be performed and what will be tested.

It’s out of scope some minor types of tests, the disaster recovery plan and the business continuity plan.

## Objectives

The Fooder is an app that calculates the people’s calorie intake by processing and analyzing the pictures of their food on a daily basis. The main goal of testing application systems is to assure that the system will meet its functional and non-functional requirements, fit the use case scenarios, and maintain the good quality of the product. The test team is responsible for testing the product and ensuring it meets their needs. In this project, both the customer and the tester are the project team.

Experitest for android and Appium for ios.

## Testing methods used

### Unit Test

Unit test is done by the developer to make sure that individual units are working as expected. Test scripts are written by the developer for each important unit in the system. It can be a method (function) of a class with all dependencies mocked up. The main goal of unit testing is to ensure that the units are working as design and handling error and exception properly for both positive and negative conditions. This type of testing is based upon white box testing at code-level. This test should be done before functional and integration testing. Identified below is an outline of the testing recommended for each application:

|  |  |
| --- | --- |
| **Test Objective** | Ensure an individual unit is functioning properly at code-level. |
| **Technique** | Execute each unit testing test cases using valid and invalid data, to verify the following:   * The expected results occur when valid data is used. * The appropriate error / warning messages are displayed when invalid data is used. |
| **Completion Criteria** | * All planned tests have been executed. * All identified defects have been addressed. |
| **Special Considerations** | * Unit test is done by the developer, not the user. |

For Java, JUnit can be used. For Python, we can use Pytest.

### Function Test

Function Testing of the application should focus on any target requirements that can be traced directly to use cases. The goals of these tests are to verify proper data acceptance, processing, and retrieval, and the appropriate implementation of the business rules. This type of testing is based upon black box techniques, that is, verifying the application (and its internal processes) by interacting with the application via the GUI and analyzing the output (results). Identified below is an outline of the testing recommended for each application:

|  |  |
| --- | --- |
| **Test Objective** | Ensure proper application navigation, data entry, processing, and retrieval. |
| **Technique** | Execute each use case, use case flow, or function, using valid and invalid data, to verify the following:   * The expected results occur when valid data is used. * The appropriate error / warning messages are displayed when invalid data is used. |
| **Completion Criteria** | * All planned tests have been executed. * All identified defects have been addressed. |
| **Special Considerations** | * Functional AI and cloud computing system are required to run these tests. |

### System Integration Test

Integration testing involves testing a set of individual modules that are combined into the complete system. We will be able to determine if independently developed units will work properly when connected to each other despite them working in isolation. Therefore, without integration testing, there is a risk that a system will fail when all its components are connected. The main components relevant to our application includes our User Interface, Artificial Intelligence, Image Processing, and Cloud Computing.

In our project we will be following the top-down incremental testing approach for system integration testing. This involves testing the User Interface component of the application first, and traversing down the tree of underlying functionalities; For every component integrated, all tests must pass.

If any code modification or requirements changes are made, that component must re-enter the integration testing pipeline to ensure the new functionality has not broken any other parts of the system.

Each component consists of a set of test cases that must pass during development which complies to its specific requirement. When several components are integrated, they must pass all their original test cases, as well as new tests that verify the behavior of the complete system. If the observed results are equal to the expected results, the test will pass and if the observed results are not equal, the test will fail.

Alpha / Beta

The purpose of Alpha test is to find out any existing bugs or errors before releasing our product for public testing. With that in mind, we will carry out our Alpha testing with the development team only.

There will be a meeting hosted with project manager and development team. Lead developer (LD) will then have the latest version of software running on their machine projected on a screen. Then LD would go through requirements from SRS and validate each of them.

Throughout this process, if all requirements are fulfilled, then we would consider Alpha testing is completed. Project Manager needs to update the development schedule for bug fixing otherwise.

On the other hand, Beta testing will carry out after Alpha testing is completed. Which will start with a beta-releasing version of the software that is public for limited number of testers.

Once the software is released, non-developer tester will be asked to perform tasks meant to validate all the requirements listed in SRS. Beta testing would consider completed when all requirements are validated.

### Acceptance

Acceptance testing will be conducted to determine whether our requirements meet our specifications. Meetings will be organized between the team members and the customer to formulate scenarios that capture his/her needs; these scenarios are used to create test cases. Acceptance tests will be written in a language that is easy for both the customer and team to understand, meaning that technical terminology should be omitted.

Acceptance tests should not be ambiguous, and any that may lead to confusion should be elaborated. Tests should only include what is required to be tested, and should accurately reflect the scenarios written. Tests will follow the format of GIVEN-WHEN-THEN, where given certain circumstances when an event happens an expected result will occur.

Scenarios and acceptance tests are identified and documented; the development stage can begin. After development, acceptance tests will be performed before by the client to gather feedback and any defects will go through re-testing and regression testing until it passes. Once all acceptance tests are passed and verified by the client, acceptance testing will be complete.

## Test Cases Examples

The test cases should ensure 100% coverage of all software requirements mentioned in the specification document. The following table shows some examples of test cases of the system:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Case ID \*** | **Test Scenario** | **Test Steps** | **Test Data** | **Expected Results** | **Actual Results** | **Pass/Fail** | **Targeted Testing Requirement or Use Case\*\*** | **Date Tested** |
| FT-001 | Check Customer Login with valid Data | 1. Open Fooder Application 2. Enter User ID 3. Enter Password 4. Click Submit | Userid = fooder100  Password = pass100 | User should login into the application | As Expected | Pass | FR-17 |  |
| FT-002 | Check Customer Login with invalid Data | 1. Open Fooder Application 2. Enter User ID 3. Enter Password   Click Submit | Userid = fooder100  Password = fail100 | User should not login into the application.  User should be prompted with an error message. | As Expected | Pass | FR-17 |  |
| FT – 003 | Able to take picture in application | 1.Open Fooder  2.Swipe to Camera tab  3.Click bottom center button to take picture | N/A | User should be asked to send the picture for analysis or not | As Expected | Pass | FR-11 |  |
| FT - 004 | Able to view saved pictures | 1.Open Fooder  2.Swipe to Camera tab  3.Click bottom left button | Some demo pictures on device | User should see all the saved pictures on screen | As Expected | Pass | FR-12 |  |
| FT - 005 | Able to view current nutrition status | 1.Open Fooder | Some demo status on device | User should see a chart and bars representing his current nutrition status | As Expected | Pass | FR-18 |  |
| FT - 006 | Able to view history | 1.Open Fooder  2.Swipe to History tab | Some demo history on device | User should see a calendar, photo food and good characteristics on screen | As Expected | Pass | FR-10 |  |
| IT - 007 | User Interface Login Access Home screen | 1.Open Fooder  2.Enter User ID  3.Enter Password  4.Click Submit  5.Login redirects user to home screen | Userid = fooder100  Password = pass100 | User should login into the application and view the home tab should be selected | As expected | Pass |  |  |
| IT - 008 | Image Processing | 1. Open Fooder  2. Swipe to Camera tab  3. Click bottom center button to take a picture  4. Image is processed in the back end and returns a set of values | N/A | Front end should receive data calculated using image processing, and is presented to the user | As expected | Pass |  |  |
| IT - 009 | Cloud Computing | 1. Open Fooder  2. Swipe to Camera tab  3. Click bottom center button to take a picture  4. Image is processed in the back end and returns a set of values  5. Image is saved in a database in Amazon Cloud | N/A | The photo taken by the user is stored in the Amazon Cloud database that consists of all photos taken by the user. | As expected | Pass |  |  |
| AT – 010 | Given a set of previously anaylzed photos, when you select the history tab you should be able to interact with a calendar to view history | 1.Open Fooder  2.Swipe to History tab  3. Click calendar date  4. View list of photos on selected date | Some demo history on device | User should be able to interact with a calendar to view their photo history | As expected | Pass |  |  |
| AT – 011 | Given that you have uploaded a photo on the current day, when you select the home screen tab you should be able to see a wheel and a set of bars that reflect the of sum nutritional value of analyzed photos (of that day) | 1.Open Fooder  2.Enter User ID  3.Enter Password  4.Click Submit  5.User is on the home screen (Default) | N/A | User should be able to view a wheel and bars reflecting nutritional intake | As expected | Pass |  |  |
| AT – 012 | Given that you are logged into the application, when you have any of the three navigational tabs selected, the navigation menu is always visible | 1.Open Fooder  2.Enter User ID  3.Enter Password  4.Click Submit | N/A | User should be able to view the three navigational tabs at all time | As expected | Pass |  |  |

\* FT = Function Test, IT = Integration Test, AT = Acceptance Test, etc

\*\* FR = Functional Requirement; NFR = Non Functional Requirement; UC = Use Case

## Schedule

The initial test schedule is described below.

|  |  |  |
| --- | --- | --- |
| **Task Name** | **Start** | **Finish** |
| Test Planning | 20/11/2019 | 25/11/2019 |
| Unit Testing | 05/01/2020 | 11/11/2021 |
| Alpha Testing | 07/04/2021 | 18/06/2021 |
| Beta Testing | 10/05/2021 | 17/07/2021 |
| Acceptance Testing | 15/07/2021 | 20/09/2021 |

# References

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[2] Payscale.com. (2019). Canada | PayScale. [online] Available at: https://www.payscale.com/research/CA/Country=Canada/Salary [Accessed 24 Nov. 2019].