



**University of
Nottingham**

UK | CHINA | MALAYSIA

Software Requirements Specification

Project Title: Drocery Store

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Revision History

Name	Date	Revision for changes	Version
Sonia	1/04/20	Initial draft shared via outlook	Version 1.0
Irdina	20/04/20	Finished writing overall description	Version 1.1
Shenuka	21/04/20	Finished writing introduction	Version 1.2
Vinuri	21/04/20	Finished writing functional requirements and user interface requirements	Version 1.3
Sonia	21/04/20	Finished writing non-functional requirements, prioritization and release plan	Version 1.4
Vinuri	22/04/20	Finished writing software, hardware interfaces and software features	Version 1.5
Vinuri	11/05/20	Simplified functional requirements after getting feedback from supervisor	Version 2.0
Sonia	12/5/20	Changed prioritization method and revised release plan	Version 2.1
Sonia	13/5/20	Added use case diagram	Version 2.2
Vinuri	13/5/20	Added Activity diagram	Version 2.3
Sonia	13/5/20	Final Version	Version 3.0

1. Introduction

This section provides a summary of the nature and outline of everything that is contained in this SRS text. It also defines the intent for this text and offers a collection of abbreviations and meanings.

1.1 Purpose

This document intends to provide a thorough overview of the “Drocery”. This will demonstrate the expected intent and full device development declarations. It will also describe device limitations, configuration, and other key program interactions. This document is meant specifically to be submitted to a client for acceptance as a guide for the implementation team to implement the first interaction of the program.

1.2 Scope

The “Drocery” a drone-based grocery store which places orders online and immediately delivers the products through drones. It is planned to expand in several cities in different countries to make it more sustainable. The company is also planning to operate several hundred drones within a few years. The drones will be purchased with standard control software which provides an interface to communicate with the software systems.

The business also wants to have a software system called DroceryControl which will integrate a large portion of the operations of the business. Where it will receive orders from customers and send them to packaging workers, who will load the items manually into allocated transport boxes which will then be connected the assigned drone. The system will also provide the drone pilots with an interface to guide the drone according to the destination of the orders.

Furthermore, much of the time the drones will fly autonomously. The DroceryControl software will provide the pilots with a control panel which will inform them about the

parameters like name of the customer, address, and coordinates. The drones are also equipped with high resolution cameras and GPS receivers which can transmit imagery and their locations in real time.

1.3 Definitions, acronyms, and abbreviations

Term	Definition
UAV	Unmanned Aerial Vehicle
Venture Capitalist	Is an investor who provides capital to firms
HR	Is a department of the business which is responsible for all thing's worker- related
CFO	Chief Financial Officer
High Resolution Cameras	More image detailed camera
GPS	Global Positioning System
ISP	Internet Service Provider
LTE	A 4G mobile communication standard
FR	Functional Requirement
PR	Performance Requirements
SAFR	Safety Requirements
SECR	Security Requirements
QR	Quality Attributes
DESC	Description
RAT	Rational
TAG	A, unique persistent identifier
DEP	Dependency
GIST	A short, simple description of the concept
SCALE	The scale of measure used by the requirement
METER	The process or device used to establish location in a scale

MUST	The minimum level required to avoid failure
PLAN	The level at which good success can be claimed
WISH	A desirable level of achievement that may not be attainable through available means

1.4 Document conventions

It is important for a business to develop familiar icons to maintain their cooperate image, and to ensure that all publications adopt a certain agreed-upon theme. Conventions about styles are significant. Even the way a text feels detracts from its readability.

When writing this SRC, group members were given to write each topic and typographical conventions such as bold font for headings and subheadings and the similar font type and size is maintained throughout this document.

1.5 Intended audience

This Software Requirements Document is intended for individuals directly in the development of this business. This includes stakeholders, team managers, project consultants and software developers.

Developers who can study the functionality of the project and recognize more quickly where their efforts will be directed towards enhancing or introducing further features to it. To design and code for potential development.

Team managers can use this guide as a framework for their evaluation plan, since it is harder to identify any problems with a specification manual. This means the study is structured more methodically.

This document does not have to be sequentially, users can skip to every segment they consider appropriate. A quick description of every document is given below.

Section 1 – Introduction

This includes a summary of this document, including purpose, scope and objectives.

Section 2 – Overall Description

A summary of the entire system is in this section. Essential functionalities, stakeholders who use the program and what features for each form would be accessible.

Section 3 – External Interface Requirements

This section includes a comprehensive summary of both inputs and outputs and communication protocols would be demonstrated by simple prototypes.

Section 4 – System Design

This includes use case diagram, Activity diagram

Section 5 – System Features

This includes all the features of the system and functional requirements.

Section 6 – Non-functional requirements

This includes the performance requirements, safety, security requirements and quality attributes.

Section 7 – Prioritization and Release Plan

This includes the choice of prioritization method and release plan

1.6 Additional information

This document also includes three sections and appendixes. The second one includes description of the features of the framework and its relationship with other systems. This section further discusses various forms of stakeholders and how they communicate with the system. In fact, this also addresses the system limitations and feature assumptions.

The third section includes comprehensive explanation of the hardware criteria and a summary of the different device interfaces. Different design methods are used to define the specifications for particular markets within greater deal.

The fourth section deals with necessary prioritization. It provides a rationale for the approaches chosen for prioritization and addresses why other alternatives were not picked.

At the end of the document, the appendices contain all the details of the prioritization of the criteria, and a production schedule catered on them.

1.7 Contact Information

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1.8 References

1. 15 Intended Audience and Reading Suggestions While the Software Requirement
<https://www.coursehero.com/file/p7nnlc8/15-INTENDED-AUDIENCE-AND-READING-SUGGESTIONS-While-the-software-requirement/>
2. UAV- <https://www.dictionary.com/browse/uav>
3. Software Requirements Specification Document with Example -
<https://krazytech.com/projects/sample-software-requirements-specificationsrs-report-airline-database>
4. What Are Prioritization Techniques? Moscow Method -
<https://blog.ganttpro.com/en/prioritization-techniques-and-methods-for-projects-with-advantages-of-moscow-model/>

1.9 Overview

This document is a thorough overview of the operating framework to be built according to its functional and non-functional requirements. This involves the use case about how consumer interacts with the software system. This also consists of all necessary requirements required for the development of the project.

2. Overall Description

In this section, an overview will be given on the entire system. The system will be explained to illustrate how it interacts with other systems and introduce the basic functionalities. This section will also discuss the type of stakeholders that will utilize the suggested system and what functionality will be available for each type.

2.1 Product perspective

The product is a new and upgraded system to deliver goods to customers using Drones. The system will consist of two components including a web interface and a control system software. The web interface will be used to allow users to do their grocery shopping online, inserting the relevant information for the delivery (e.g. name, address, time slot etc.). The web interface will manage the information about the user which will be communicated to the control system.

As the web interface is used by Drocery clients to input their necessary delivery details, a navigation application is needed. The web interface will use a Global Position System (GPS) within the web interface, communicating to a physical GPS device to assist Drocery clients to select their delivery location. The GPS functionality will be implemented in the interface for users to easily use the function while using the web interface.

A database is required to manage all the data from Drocery. The web interface and the Drocery control system software will have access to the database but both will use the data differently. The web interface will use the database to add and modify data for the Drocery control system to retrieve.

2.2 Product functions

As the system is made up of two parts, the product functions will include features for the web interface and the control system software. Using the web interface, Drocery customer users will be catered to their shopping needs with the following features:

- Scanning through the available items at the store in a catalogue form
- Selecting desired items to 'Add to Cart'
- Choosing payment method (online bank transfer/cash on delivery)
- Adding the delivery address, GPS feature will be available to assist users to find their desired
- Selecting best suited delivery time for customer
- Confirmation (emails will be sent from the DroceryControl to the customer, confirming all their delivery details)

The web interface of Drocery will communicate with the control system software named DroceryControl. Information passed by a customer from the web interfaced will be put into a database for the control system software to access. The control system software will be used on a regular basis by the employees of the company to allow the employees to perform their job.

2.3 User classes and characteristics

There are different types of users interacting with the system including Drocery customers, the Drocery employees, and administrators. Each type of user has a different use for the system as each type of user has their own requirements.

Drocery customers are the primary users of the web interface. The main aim of the user is to shop by browsing through the available items and buying it from the comfort of their own home. To shop, the user must create an account before selecting items to buy and filling all the required fields for the company to deliver their items. The data the user gives to the web interface will be communicated to the DroceryControl.

The employees of the company are the primary users of the control system software named DroceryControl. DroceryControl stores all the information about the customer for the employees to utilize. Relevant information will be distributed according to specific job positions.

The administrators of Drocery (executive positions) will overlook the entire project, their primary focuses on the web interface and the software system. Administrators make sure everything is functioning correctly with no distribution of misinformation and take the necessary actions if a problem arises.

2.4 Design/Implementation Constraints

Internet connections can form a massive constraint on the system. Data needs to be communicated from the web interface to the software system. As most data is transferred through the internet, it is essential that there is an internet connection for the application to function.

Both the web interface and the software system will have constraints from the database capacity. As the database is shared by all applications, it can be forced to queue incoming requests and increase the time it takes for the data to be collected.

As Drocery's main objective is to deliver with the use of Drones, aviation authorization and other legal actions may form constraints on the system. Before deploying the business, the company must get approval from authorities to avoid delays for customers and avoid potential business losses.

2.5 Operating environment

The product consists of two parts, a web base interface and a software system, both of which require the internet to communicate with one another. A database is necessary to allow the transmission and management of data between the two components.

As the web base interface is online, it is operational on multiple device platforms including mobile devices. A GPS (Geographical Positioning System) application must be available to allow users of the web base interface to easily locate their address for their delivery.

2.6 User Documentation

User documentation is intended to help end users to use the product. There are two main types of users for the product therefore two types of user documentation is required. Drocery customers will mainly use the web interface to do their online shopping. Should the customer require assistance in using the web interface, online help will be made available within the website. The web interface will not require much user documentation because the interface aims to be as simplistic and easy to understand for its customers.

The employees of the company will receive a different type of user documentation for the software system. A user manual and video tutorial will be made available to assist in using the system. The administrators of the company will also receive the user manual and video tutorial to ensure everything is running smoothly.

2.7 Assumptions and dependencies

Assumptions and dependencies will discuss the factors that if changed, can affect the requirements of the product. The factors are as follows:

- Operations of the drones must be approved by the aviation authorities which may require time and set delays in deployment of project.
- Pilots must undergo a test to prove their proficiency in operating drones through an internal assessment program before receiving access to DroceryControl software system. The test, though necessary for safety, is time consuming.
- Drone delivery is reliant on the weather and unable to deliver at night or under harsh weather conditions (e.g. heavy rain) which is disruptive to deliveries.
- Development of the DroceryControl software will take time and set delays in deployment.

2.8 Apportioning of requirements


In the event the project is postponed, certain requirements can be passed to the next iteration of the application.

3. External Interface Requirements

This section will provide a detailed description of all inputs into the and outputs from the system. Furthermore, the interfaces of software, hardware and communication protocols used will be shown through basic prototypes.

3.1 User Interfaces

As a first-time user, customers will have the option of registering. The mobile application version is available only to the Drocery customers and the rest of the admin staff and employees will have to use the web portal in order to register and/or login.



The image shows a login page for 'DROCERY CONTROL'. It features a title 'DROCERY CONTROL' at the top. Below the title are two input fields: 'Username:' and 'Password:'. Each input field is represented by a light blue rectangular box. Below the password field is an orange 'Log In' button. At the bottom of the page, there is a link that says 'Not registered? Click here' in blue text.

Figure 2: Login Page for users

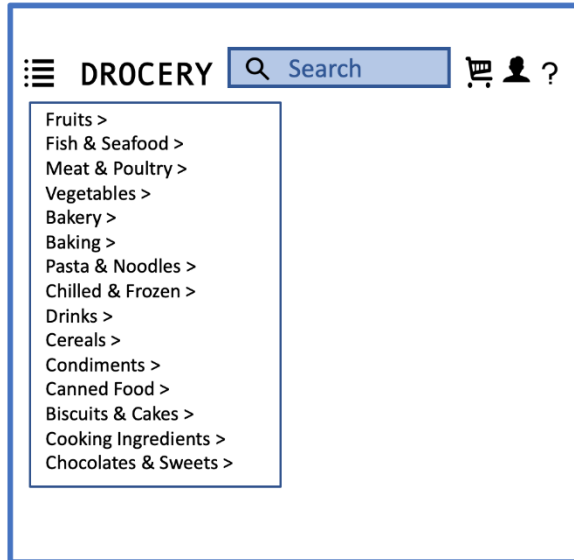
Figure 1 shows the register/login page for DroceryControl Users. This will allow both customers and Drocery employees to login to the system. Users will have to choose whether they are admin, pilots, customers or charge-men, when entering initially

registering. Depending on which type they register as, the interface they will be shown will change.

MY ACCOUNT	PERSONAL DETAILS
My Account	Name: Ernest Hemmingway <input type="button" value="EDIT"/>
My Store Credit	Email: Ernie44@hotmail.com
My Memberships	Password: ***** <input type="button" value="CHANGE PASSWORD"/>
Orders & Tacking	ID: 12345678
Exchange & Returns	Contact No: 077-4545456
Preferences	
	BILLING/SHIPPING ADDRESS
	The University of Nottingham, Malaysia Campus <input type="button" value="EDIT"/>
	Jalan Broga, Semenyih, Selangor 43500

Figure 2: Profile Page for users

Figure 2 shows the profile page for Drocery customers. All personal details as well as shipping information will be saved here. Customers are also able to check the progress of their orders and view past complete orders. My membership section is used to identify VIP customers. The profile page of customers will be slightly different from the rest of the staff. For an example, the personal details will remain. Pilots and admin do not require the shipping address section, but charge-men do, because they are hired from existing customers. They will have a separate section that will keep track of the usage of their charging stations and then convert that to store credit.



3: Search products

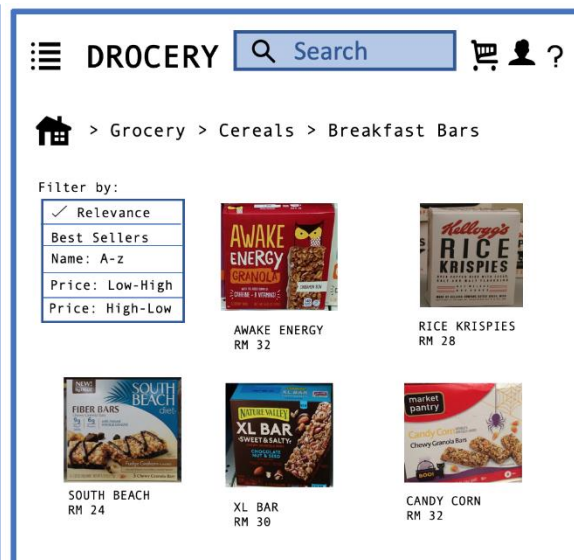


Figure 4: Product page

Customers can search for products in a few different ways. Figure 4 shows the dropdown menu that list the products available under specific categories. Users will be easily able to select the product they want through this. Another method of searching for a product would be to type the required product into the search bar on top of the page. Users do not have to be very specific, just typing fruits will return all fruits available in the store. The next figure shown above has the results displayed in a grid manner. All search results will be automatically displayed like this.

Users so can filter their search results using the filter by drop down. See figure 5. Users can sort the results according to the list shown. This is done in order to narrow down the list of products so that users can have an easier time choosing products.

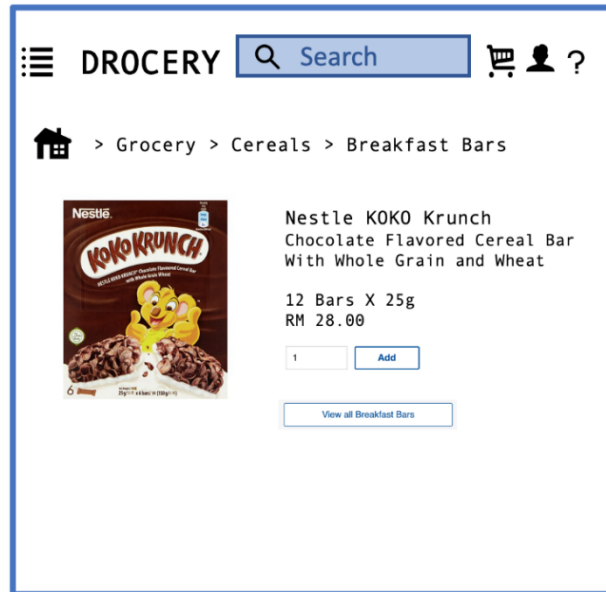


Figure 5: Product information page

Clicking on a product will take you to that products information page. All information regarding that product will be available here. User is also able to add products to their “shopping cart” by clicking on the add button. Quantity of the product can be set using the text box.

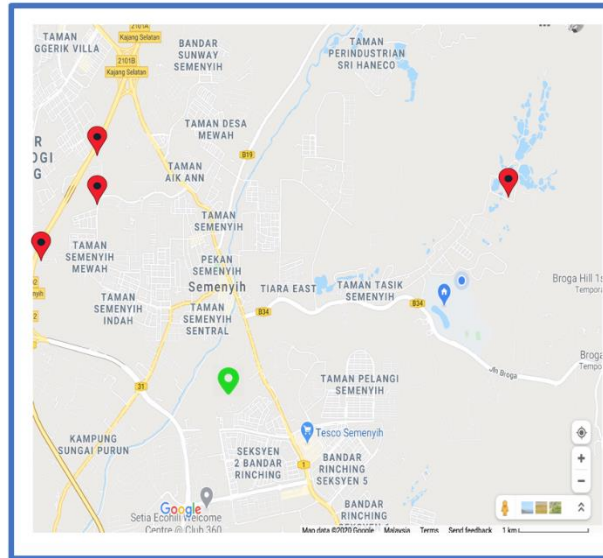


Figure 6: Displaying delivery coordinates

In the map view above, the destination addresses of one drone is marked with the red markers. The green marker displays the current location of the drone. This is a rough sketch of what a pilot will be able to see when he/she wants to view the delivery addresses. Pilots are also able to see in real time through the high-resolution cameras mounted in the drones.

3.2 Hardware interfaces

The users will interact and communicate with the Drocery Control System using the web interface which will be accessible through any device that is able to connect to the internet. Customers will be able to place orders through a mobile application as well. This will present the same functionality as the web interface, so the two can be used intraoperatively.

Pilots are able to communicate with the drones through inbuilt standard control software that the drones were purchased with. This software can communicate with other external software systems. As a result, the pilots will login to the Drocery Control System and access the drone control software system through that.

Charging stations are solely used to charge the batteries of the drones as a result they do not have to communicate with any other hardware or systems. Since locations are fixed, they do not have to relay their coordinates. Also, the Drocery system will automatically assign drones to the nearest charging station so they won't be any clash between drones trying to use the same charging station.

The drones come equipped with GPS receivers and high-resolution cameras. These services should be connected to the DCS throughout delivery. This too is done by the drone software itself. The Drocery Control software just needs to be open to communication.

The transport boxes will have temperature sensors mounted on them. They will read the temperature inside the box throughout the delivery and relay that to the Drocery Control System in real time. The system should decide whether to continue with delivery or to abort delivery based on these incoming data.

Charge-men, packing employees do not require any specialized hardware or software. Any computer, be it a laptop, workstation or a notepad can be used to access the Drocery Control System. Although for packing employees, a notepad/iPad would be more feasible for mobility purposes.

3.3 Software interfaces

Communication between the drones and the DCS is done through the drone software. The GPS receiver attached will send real time coordinates to the system throughout delivery. The system will use this to ensure the drone is following the correct route. Imagery from the High-resolution camera too will be sent to the system in real time.

DCS should be able to store information from the web portal and the mobile application will be saved in the same database of orders and products. This means that the app and the website have the same functionality. System will automatically check product availability from the database before confirming orders.

Drocery Control System should be able to interoperate with the specialized accounting software AbaSaga. The system shall send all information relevant for billing and debt collection to the accounting system.

The system should check the payments made through AbaSaga and orders that have been paid will be stored in the database.

Anyone who wants to be a charge-men should first register on the Drocery website. The website will send the application to the Drocery Control system and then inform the system administrators, who will decide from case to case.

Customer details such as first name, last name, DOB, gender, billing address, shipping address will be saved in the database. When their information is saved, they will be assigned a unique identifier by the system.

The backend of the system provided the feature where the admin can manually input the names, prices and available quantities of existing and new products at any time.

The backend should also allow performing statistical analyses and displaying graphs. This can be used to assign VIP customers according to their number of orders.

A geodata service will provided map data and map the customer addresses to coordinates. These data must be entered into the system in order for the drones to know their target locations and the best way to get there.

3.4 Communication protocols and interfaces

Basic communication between the system and its customers as well as the outsourced employees are carried out via email. There are a few instances where the system will generate automatic emails to be sent out. Following are those such instances.

At the end of each month, the system should produce an overview for each charging station with the time and duration of charging events and the amount of energy provided. This will then be sent to the charge-men by email.

The system should access AbaSaga system and check the payment status of orders. If the system discovers that an order has not been paid for more than 45 days after delivery, an email will be sent to the customer with order and payment details. Also, payment details stored in AbaSaga must be synchronized with payments details in the Drocery database.

Every time an order is accepted by the system, the system should confirm the order by sending an email to the customer.

Since all users but the admin will access the software system through the web interface, a standard internet connection is required. The required files, emails and data will be transferred through FTP and HTTP protocols.

Once an order is confirmed, the system will assign a packing employee to that order. The system should send a notification to said employee stating that he or she has been assigned a new order.

Drones move quite fast and in this case with significant baggage. Therefore, latency between the drones and Drocery system should be minimum. Between a pilot's input and a drone's reception of it the latency should not surpass 200ms. To do this a stable internet connection is required. Pilots will be given access to a broadband internet connection from Pepper through their LTE mobile network. This connection has to be secured against unauthorized access and any manipulations.

4. System Design

4.1 Use case Diagram

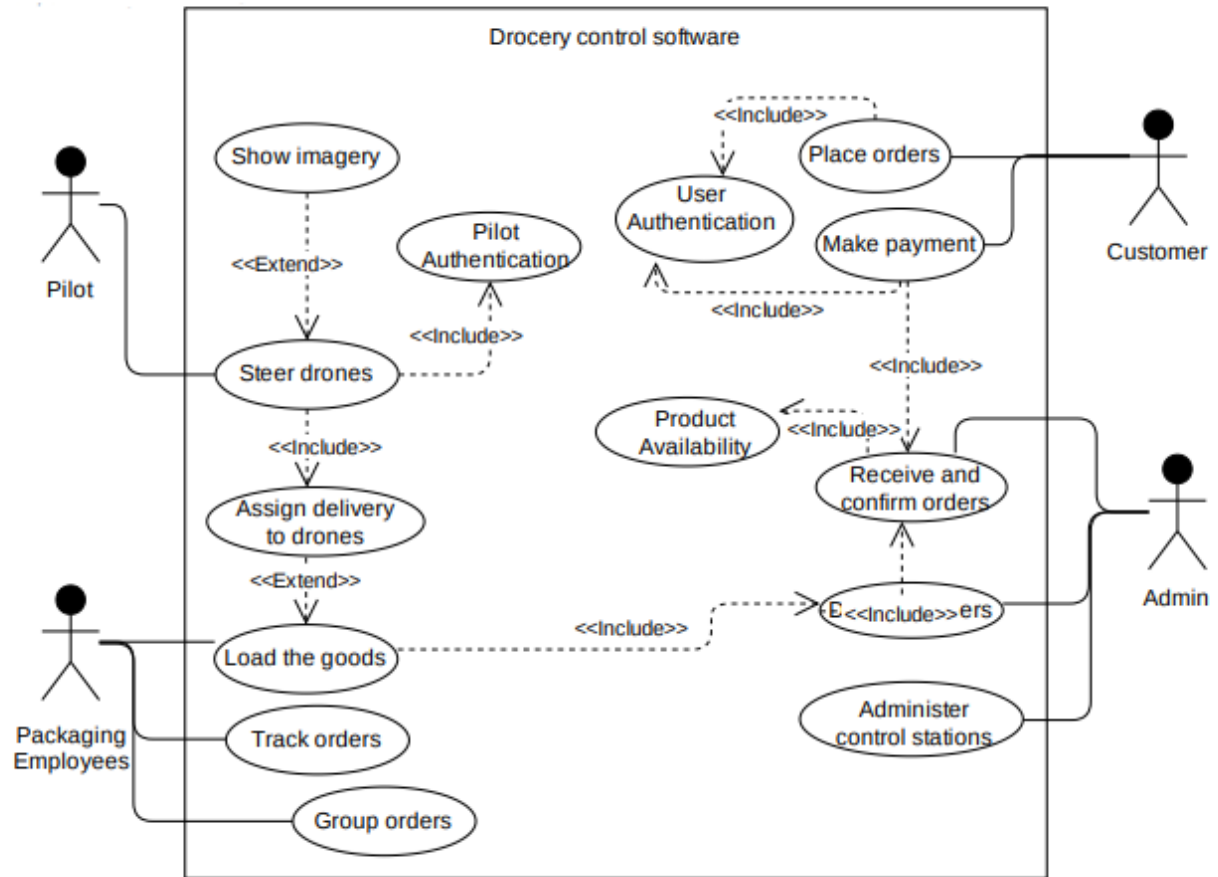


Figure 7: Use case Diagram

Figure 7 shows the interaction of different users with the system.

4.2 Activity Diagram

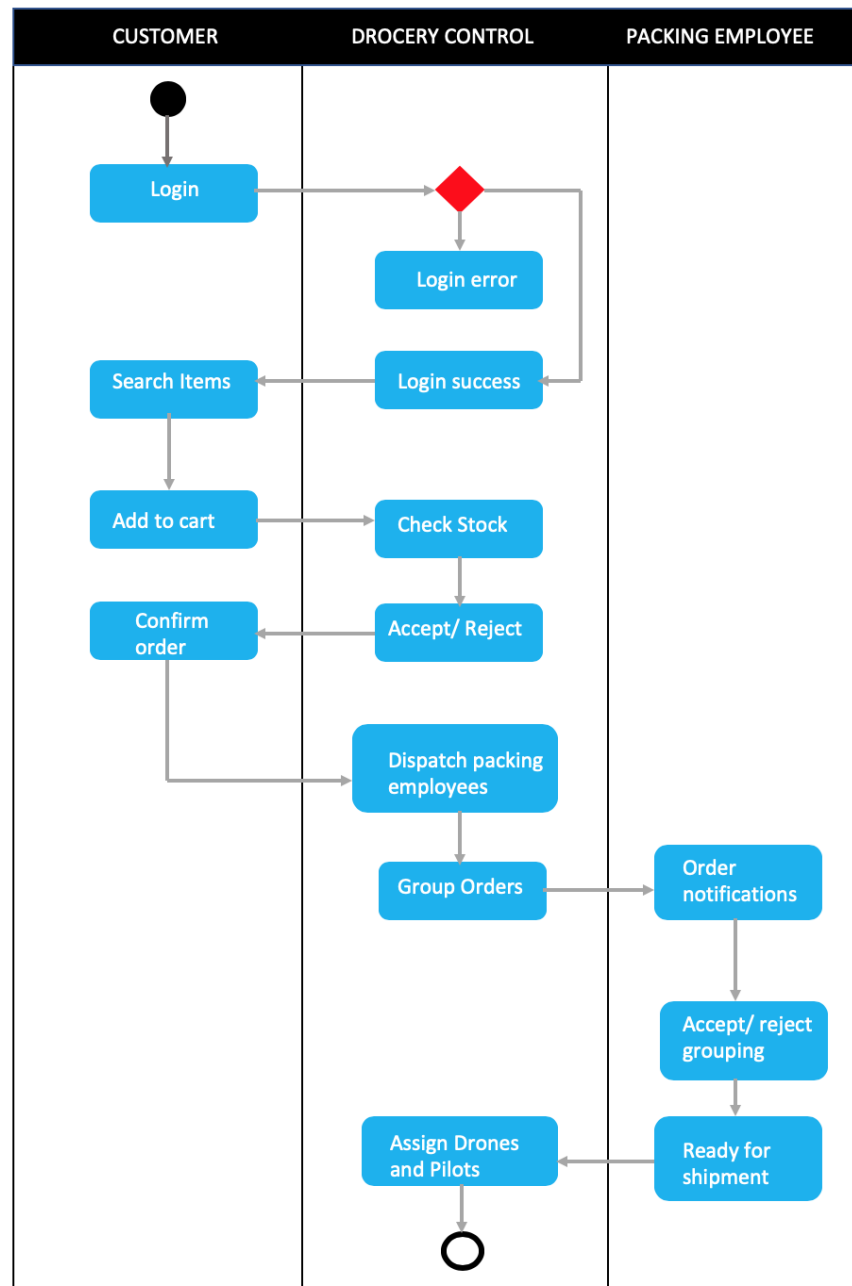


Figure 8: Activity Diagram Part 1

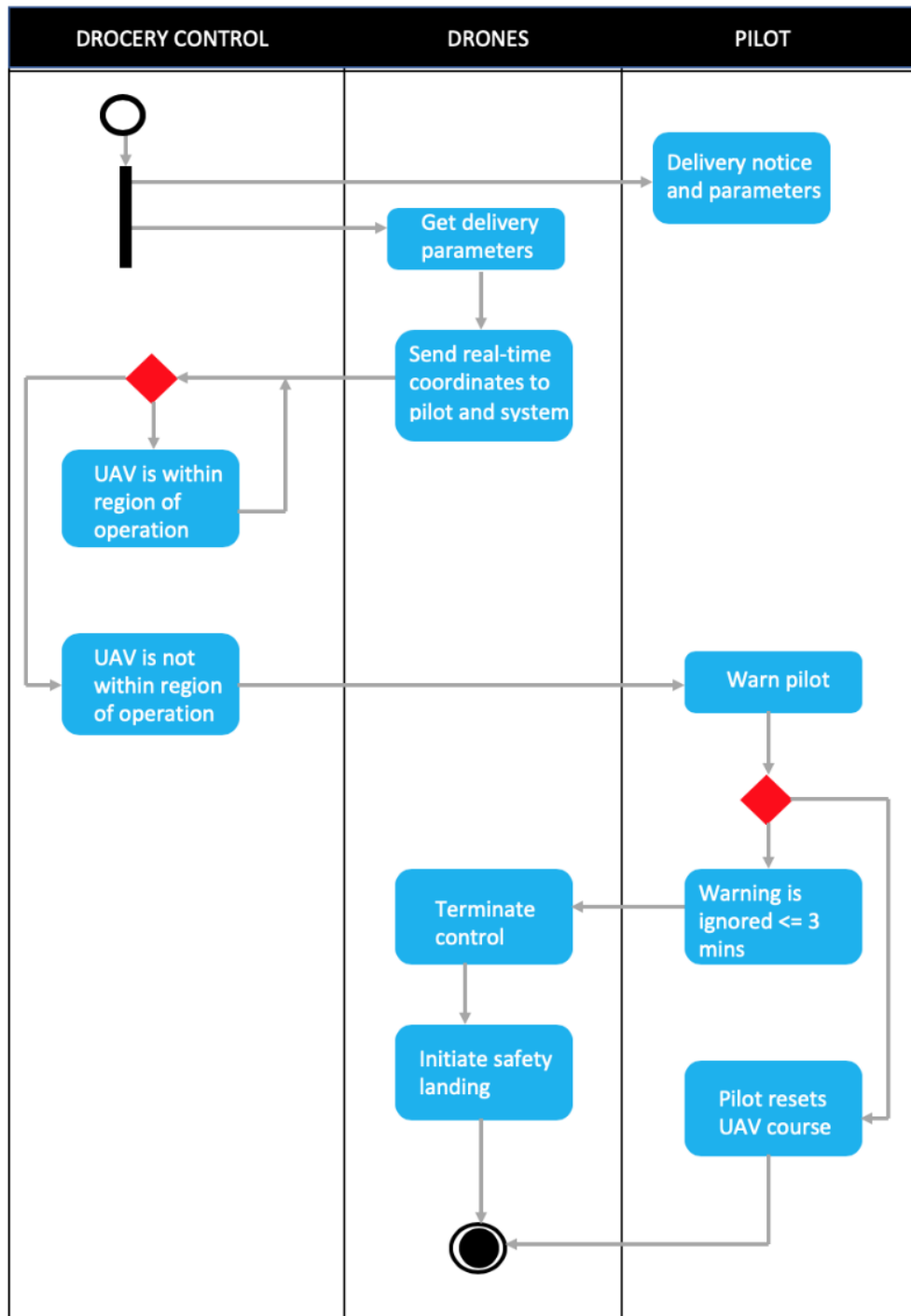


Figure 9: Activity Diagram Part 2

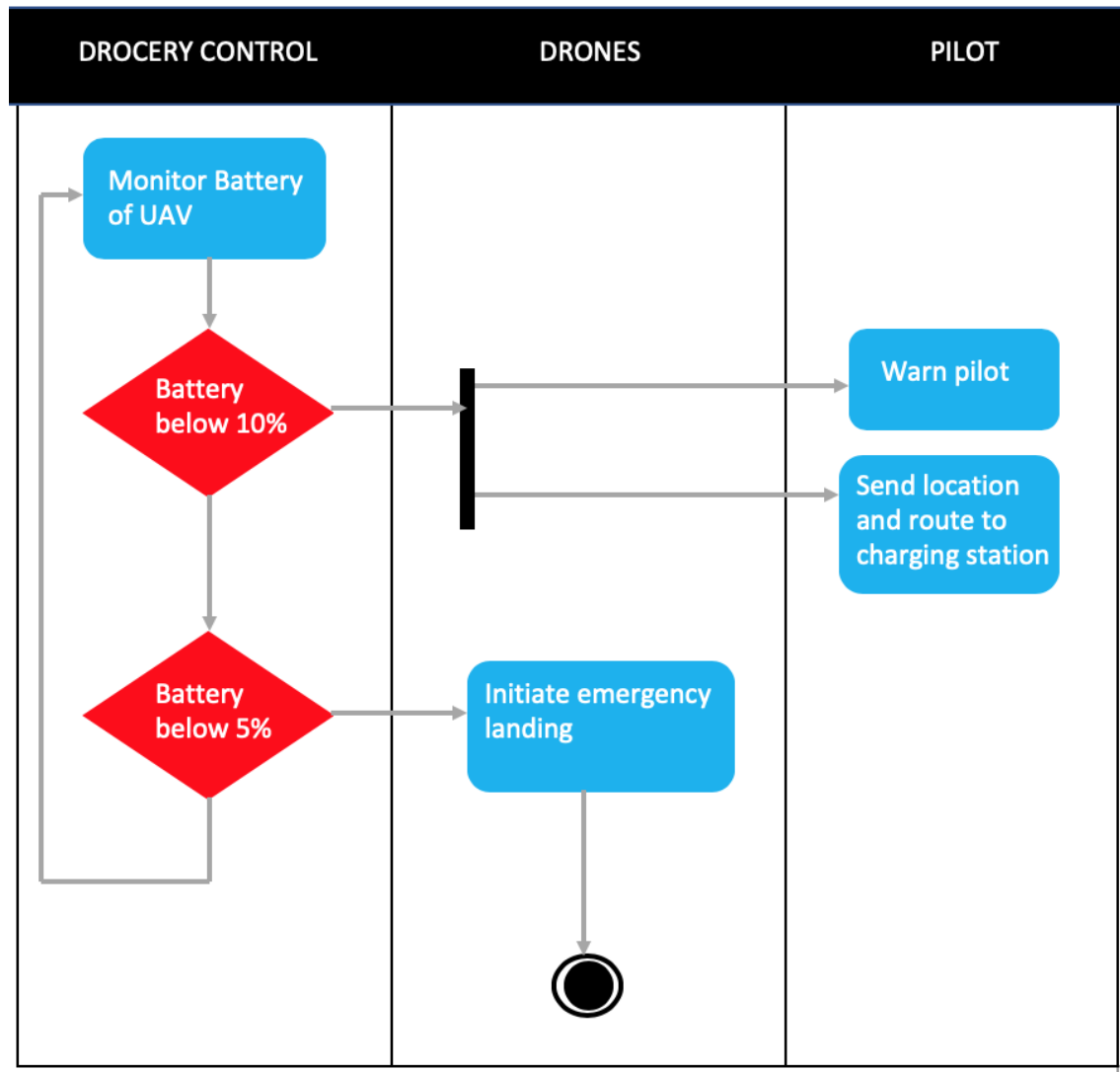


Figure 10: Activity Diagram Part 3

Figure 8 shows the various activities system between three users: the customer, DroceryControl System and Packing employees. Figure 9 and 10 shows the activities between the system, drones and pilots.

5. System Features

A system feature is an externally desired service by the software system that may require an input to affect the desired result. In this section each feature is generally described with its inputs, sequence of operations, results/outputs, and priority.

5.1 System features, description and priority

System Features	Description	Input / Output	Priority
Drones will fly autonomously most of the time	Since autonomous drones are considered reliable and versatile enough, Drones will fly by themselves. Pilots will mostly supervise operations.	Input: Mapping data from the geodata service. Output: GPS data and high-resolution imagery will be sent to the system.	1
Pilots will be able to take over control when they deem this necessary.	In case of an emergency or if they delivery route is considered difficult a pilot should be able to initiate manual flight control.	Input: System will terminate drone control and initiate manual override. Output: Instructions from the pilot will be sent to the drone control software.	1
Dispatching packing employees	Once an order has been confirmed, the system will check available packing employees and assign the task to one of them.	Input: Order confirmation Output: Send notification to packing employee	2

Receiving order from customers.	When a customer clicks on the add button on the product webpage, the system will check the database to see the availability of the product in the requested amount and then accept the order.	Input: Customer clicks on button requesting product Output: Cross reference with database and accept order.	1
Login credentials to all employees	Since each type of employee oversees different tasks the system features, they must access are different. So, each employee should have unique credentials.	Input: Users will enter username and password. Output: credentials will be crosschecked with the database and access will be granted.	1
Pilots will be responsible for 5 drones at a time	Since drone operations are autonomous, overseeing 5 is feasible. The system will assign deliveries and give the parameters.	Input: Inputs from pilots will be handed over to the drone control software. Output: Data from the drone will be handed over to the Drocery control system.	3
Initiating autonomous safety landing of the drone.	If a UAV is out of a defined region of operation and if the pilot ignores the system warning, the system will terminate the	Input: Data regarding the drone's location.	1

	pilot's control and initiate autonomous landing.	Output: issues warning to pilot. System takes control of drone	
Charge-men will receive a certain amount of credit in return for the usage of their charging station.	Charge-men will get a credit according to the logged usage of their charging station. At the end of each month, the system will calculate time and duration of charging events and compensate accordingly.	Input: Data regarding the amount of energy provided by the charging station Output: Credit value to transferred to charge-men's account.	3
Battery status of drones are constantly monitored.	If charge of a drone drops below 10% a warning is issued, and location of nearest station is given. If charge is below 5% or if the station cannot be reached the system will initiate emergency landing.	Input: Charge percentage of the drone throughout delivery. Output: Send warning to pilot and give new coordinates to charge station.	2
Temperature sensors will monitor the temperature inside the transport boxes.	Temperature will be continuously monitored. If the temperature gets out of an allowed range the system will abort the delivery.	Input: Data from the temperature sensors. Output: If temperature is not acceptable system will start delivery abort process.	3

Customers will be able to place orders through a web interface and a mobile application.	Web interface will be a part of the Drocery Control system and the mobile app will communicate with the system. Data from both will end up in the same database.	Input: System will check availability of product from database. Output: Order is confirmed. User is sent an email.	2
Shipping orders together.	Several orders can be shipped together if total weight limit is not exceeded. System will calculate possible routes and suggest groupings.	Input: Packing employee is shown possible groupings Output: Packing employee will accept or reject suggestion.	3
System backend will allow statistical analyses.	System should keep track of the number of orders daily, monthly and which products sell the most and what sells least, common delivery locations, frequent customers and so on.	Input: Data regarding orders, frequent customers, bestselling products, monthly orders etc. Output: Analytical graphs and tables	3
Drocery system should interoperate with ABA Saga software.	The two system should be able to send and receive information to each other, both automatically and through user commands.	Input: Information regarding billing and debt conformation Output: Payment details	1
System should send notifications	Drocery system should access the ABA Saga	Input:	

to customers who have not paid yet.	interface and get a list of customers who haven't paid yet and send reminder emails to them.	Payment information from AbaSaga Output: Remainder emails to customers	3
Drocery system should be able to incorporate future functionalities that involve restaurants.	The system should be able to add restaurants deliveries. Customers will be able to order through the web portal or app and that information will be sent to the restaurant, who will inform the system once products are ready for delivery.	Input: Order details from customers regarding restaurant products Output: Informing restaurant of order and getting their notification that product is ready.	3
Each order is assigned a unique ID	System will automatically assign a unique ID to every order in order to track its progress.	Input: Order confirmation from customer Output: System will generate ID	2
Customers can abort a started order.	Some customers will discard an order midway through without purchasing items. In this case items that are saved in the shopping card must be discarded as well as any other relating data.	Input: Customer aborts order Output: Discard all relating data	2

Information from customers will be saved in the database.	If a customer is not using the system for the first time then, their saved data will be used.	Input: Making an order Output: Displaying customer data from database.	3
System should only accept orders from Semenyih.	Since the operating city is currently only Semenyih, outside orders will not be accepted.	Input: Check delivery address before ordering. Output: Accept or reject order	1
Tracking the progress of an order.	System should be able to identify when a order is “packing”, “ready for shipment”, “in delivery” and so on. This is done by sending notifications and conformation emails to the users.	Input: Confirmation from customer, packing employee and pilot. Output: Tracking the order	3
Product details must be saved in the database.	Information relating to products like product ID, name, current price etc. of each product must be saved in the database.	Input: product ID, name, current price, available quantity, expire and manufacture date Output: Used as reference before confirming orders and for restocking	1

5.2 Functional requirements

Functional Requirements is a description of the various services that the system must offer.

Functional Requirement 5.2.1

ID: FR1

TITLE: Steering drones

DESC: The system will provide an interface for drone pilots to steer the drones according to the destination orders. Each pilot can be responsible for the operation of up to 5 drones at the same time. The pilots will be shown the drones assigned to them and a map of their current location as well as the location of their target.

RAT: In order for pilots to steer drones in case of an emergency.

DEP: FR2, FR3

Functional Requirement 5.2.2

ID: FR2

TITLE: Assign deliveries to pilots

DESC: The system will present a control interface to pilots that will assign deliveries to them and inform them about their parameters such as name of the customer, address, coordinates. The inputs from the pilots will be handed over by the DroceryControl system to the drone control software.

RAT: In order to automatically assign orders with drones and pilots.

DEP: FR1

Functional Requirement 5.2.3

ID: FR3

TITLE: Real time location data

DESC: The high-resolution camera and GPS receivers mounted on the drones will send imagery and data in real-time to the DroceryControl system. The pilots should be shown the sight of the drones assigned to them and a map with their current positions as well as target locations.

RAT: In order to view real time location of drones

DEP: FR1, FR2

Functional Requirement 5.2.4

ID: FR4

TITLE: Checking if UAV is within a defined region of operation

DESC: During deliveries, the system has to continuously check if the UAV is still within a defined range of operation. If this is not true, a warning will be issued to the pilot. If the warning is ignored for more than 3 minutes, the system will terminate control of the respective pilot and initiate autonomous safety landing of the drone.

RAT: In order to ensure that the drone is within a defined region.

DEP: FR2, FR3

Functional Requirement 5.2.5

ID: FR5

TITLE: Administer the control stations

DESC: Charge-men will get a credit according to the logged usage of their charging station. At the end of each month the system should produce an overview of each charging station with the time and duration of charging events and the amount of energy provided.

RAT: In order to ensure the charge-men to get credited.

DEP: None

Functional Requirement 5.2.6

ID: FR6

TITLE: Check product availability before accepting order.

DESC: each time a customer adds a product to the order, the system will check if its available in the requested quantity and will reject the addition if that's not the case.

RAT: To ensure that orders are placed according to available stock.

DEP: None

Functional Requirement 5.2.7

ID: FR7

TITLE: Send order confirmation email

DESC: Once the customer has completed an order and it is accepted by the system, the system should confirm the order by sending an email to the customer.

RAT: To confirm an order with a customer.

DEP: FR6

Functional Requirement 5.2.8

ID: FR8

TITLE: Dispatching packing staff

DESC: Once an order is accepted by the system, the system should start the dispatching process for the packing staff. The packing employees will be shown a notification on his system screen that they received a new order and they will be able to view a list of orders assigned to them.

RAT: In order to dispatch the packing staff and inform them of new orders.

DEP: FR6, FR7

Functional Requirement 5.2.9

ID: FR9

TITLE: Grouping orders together

DESC: The system should calculate possible routes and total weight of packages and suggest groupings of orders to the packing employees. The staff can either accept or reject the suggestions.

RAT: Grouping orders together to reduce number of drone deliveries

DEP: None

Functional Requirement 5.2.10

ID: FR10

TITLE: Perform statistical analyses and display graphs

DESC: The backend should allow the administrator to perform statistical analyses and display graphs. Like the number of orders per month, FLAG customers as VIP according to their order volume.

RAT: In order to view the order volume and customer usage.

DEP: FR6

Functional Requirement 5.2.11

ID: FR11

TITLE: Additional quality control for VIP customers

DESC: The system should enforce quality control and additional confirmation by a supervisor for orders that are made by VIP customers.

RAT: In order to provide extra services to VIP customers.

DEP: FR10

Functional Requirement 5.2.12

ID: FR12

TITLE: Send payment notifications to customers

DESC: The system should check the payments made through the interface of AbaSaga and send notifications to customers who have not paid for their orders yet. If an order is paid for then it will be stored in the database, if an order has not been paid for until more than 45 days after delivery, the system will send an email to the customer reminding them to make a payment. Email will include order and payment details.

RAT: In order to notify customers regarding their order payments.

DEP: None

Functional Requirement 5.2.13

ID: FR13

TITLE: Tracking and confirming an order

DESC: The system will automatically track the progress of orders. Once a customer completes an order, the system will ask the user to check and confirm the order and enter their personal data including first name, last name, DOB, gender, billing address, delivery address. Information will be stored in the system and be assigned a unique identifier.

RAT: In order to ensure that customers don't have to enter details every time they shop.

DEP: FR6

6. Nonfunctional Requirements

Requirements that specifies criteria used to judge the operation of a system rather than specific behaviors.

6.1 Performance requirements

The requirements in this section will provide detailed specification of the user interaction with the Software system DroceryControl. Also, the measurements placed on the system performance.

Non-Functional Requirement 6.1.1

Place orders

ID: PR1

TITLE: Place orders

DESC: The customers must be able to place orders easily.

RAT: In order for a user to place orders easily.

DEP: none

Non-Functional Requirement 6.1.2

Receive orders

ID: PR2

TITLE: Receive orders

DESC: The system should receive orders from customers and the customers should get a confirmation email on time.

RAT: In order for the customers to get confirmation of their order that it has been received and is ready to dispatch.

DEP: PR1

Non-Functional Requirement 6.1.3

Dispatch orders

ID: PR3

TITLE: Dispatch orders

DESC: The system should dispatch the orders to packaging employees and the employees should get a complete list of orders on time.

RAT: In order for the packaging employees to get a complete list of orders.

DEP: PR2, PR1

Non-Functional Requirement 6.1.4

Feature to steer the drones

ID: PR4

TITLE: Feature to steer the drones

DESC: The system should provide an interface for the drone pilots to steer the drones according to the destination of the orders.

RAT: In order for the drone pilots to steer the drones.

DEP: none

Non-Functional Requirement 6.1.5

Control interface for pilots

ID: PR5

TITLE: Control interface for pilots

DESC: The system should present a control interface to pilots, assign the deliveries to them and inform them about their parameters for e.g. name of customer, address and coordinates.

RAT: In order for the pilots to be assigned with deliveries.

DEP: none

Non-Functional Requirement 6.1.6

See the drones

ID: PR6

TITLE: See the drones

DESC: The pilots must be shown the sight of the drones assigned to them and a map with their current position as well as the location of their targets.

RAT: In order for the pilots to see their assigned drones.

DEP: none

Non-Functional Requirement 6.1.7

Operate the drones

ID: PR7

TITLE: Operate the drones

DESC: The pilots must be able to operate 5 drones at the same time and not more than that.

RAT: In order for the pilots to operate the drones

DEP: none

Non-Functional Requirement 6.1.8

Show map to the pilots

ID: PR8

TITLE: Show map to the pilots

DESC: The pilots must be shown a map with current positions of the drone as well as the location of the target

RAT: In order for the pilots to be able to view the map

DEP: PR6

Non-Functional Requirement 6.1.9

Administer control stations

ID: PR9

TITLE: Administer control stations to charge the drone

DESC: The system must produce an overview for each charging station with the time and duration of charging events and the amount of energy provided. The chargermen will then get a credit according to their logged usage

RAT: In order to charge the drones as they run out of power very quickly.

DEP: none

Non-Functional Requirement 6.1.10

Shipment of orders

ID: PR10

TITLE: Shipment of orders

DESC: The system must allow more than one orders if the total weight doesn't exceed the drone's limit.

RAT: In order to ship more than one orders with a drone at the same time.

Non-Functional Requirement 6.1.11

Grouping of orders

ID: PR11

TITLE: Grouping of orders

DESC: The system must calculate possible routes and suggested groupings of orders and send the proposal to the packaging staff

RAT: In order for the orders to be grouped for shipment.

DEP: PR10

Non-Functional Requirement 6.1.12

Tracking orders

ID: PR12

TITLE: Tracking orders

DESC: The system should be able to track orders per month and flag certain customers.

RAT: In order for the system to track orders

DEP: PR10

Non-Functional Requirement 6.1.13

Accounting system

ID: PR13

TITLE: Accounting system

DESC: The droceryControl system should send all information relevant for billing and dept collection to accounting system

RAT: In order to be able to interoperate with specialized accounting software.

DEP: PR10

6.2 Safety requirements

The requirements in this section will specify the safety measures that are taken for the software system.

Safety Requirement 6.2.1

Reliability of drone control software

ID: SAFR1

GIST: Reliability of drone control software

DESC: The drone control software must be extremely reliable; Drones are moving quite fast therefore latency has to be as small as possible

SCALE: Latency may not surpass 200 ms between a pilot's input and reception by the drone.

Safety Requirement 6.2.2

Stable internet connection

ID: SAFR2

GIST: Stability of internet connection.

DESC: The pilots will have broadband stable internet connection to avoid any accidents.

DEP: none

Safety Requirement 6.2.3

Autonomous safety landing of drone

ID: SAFR3

GIST: autonomous safety landing of drone

DESC: If the drones are not in the defined region of operation the system will issue warning to the pilot and if the warning is ignored for more than 3 minutes the control will be terminated and autonomous safety landing of the drone will be initiated.

MUST: warning must not be ignored for more than 3 minutes otherwise autonomous landing will be initiated.

Safety Requirement 6.2.4

Emergency landing of the drone

ID: SAFR4

TITLE: Emergency landing of the drone

DESC: The battery charge status of each drone must be continuously monitored

SCALE: If the battery charge status drops below 10% warning is issued and if it drops below 5% and the next charging station cannot be reached then emergency landing is initiated.

MUST: the charge status must be above 10%

Safety Requirement 6.2.5

Aborting delivery

ID: SAFR5

TITLE: Aborting delivery

DESC: The temperature inside the transport boxes must be continuously monitored.

SCALE: If it's out of the allowed temperature range the delivery must be aborted from the drocery control system

MUST: temperature must be in allowed temperature range

6.3 Security requirements

The requirements in this section will specify the security measures that are taken for the software system.

Security Requirement 6.3.1

Access to DroceryControl Software

ID: SECR1

TITLE: Access to DroceryControl Software

DESC: The system will provide login credentials to access.

RAT: In order for the pilots to access DroceryControl software

DEP: none

Security Requirement 6.3.2

Secure internet connection

ID: SECR2

TITLE: Secure internet connection

DESC: The connection has to be secured against unauthorized access and any manipulations or jamming.

RAT: In order for the internet connection to be secured

DEP: none

Security Requirement 6.3.3

Create account for user

ID: SECR3

TAG: UserCreateAccountSecurity

GIST: Security of creating account for users

SCALE: If a user wants to create an account but the username is already taken then the user should be asked to choose a different username.

METER: Measurements obtained on 1000 hours of usage during testing.

MUST: 100% of the time.

Security Requirement 6.3.4

Create account for pilot

ID: SECR4

TAG: PilotCreateAccountSecurity

GIST: Security of creating account for users

SCALE: When the pilot wants to create an account, but the username is already taken which he wants to use then user should be asked to choose a different username.

METER: Measurements obtained on 1000 hours of usage during testing.

MUST: 100% of the time.

Security Requirement 6.3.5

Communication security

ID: SECR5

TAG: CommunicationSecurity

GIST: Security of the communication between the system and server.

SCALE: The messages should be encrypted for log-in communications.

METER: Attempts to get username and password through obtained messages on 1000 log-in session during testing.

MUST: 100% of the Communication Messages in the communication of a log-in session should be encrypted.

Security Requirement 6.3.6

Check on UAV

ID: SECR6

TAG: Check on UAV

DESC: The system should continuously check position of drone

SCALE: If it's not in the defined region the system should issue warning to the pilot.

METER: Measurements obtained during testing of drone.

MUST: UAV must be in the defined region of operation.

6.4 Software quality attributes

The requirements in this section specify the required reliability, availability, portability and maintainability of the software system.

6.4.1 Reliability

ID: QR1

TAG: SystemReliability

GIST: The reliability of the system.

SCALE: The reliability that the system delivers the right product and on right address on time.

6.4.2 Availability

ID: QR2

TAG: SystemAvailability

GIST: The availability of drocery software system without any interruptions.

SCALE: Drone delivery requires daylight at the moment so should be available at that time.

METER: Measurements obtained from 1000 hours of usage during daylight.

MUST: More than 98% of the time.

PLAN: More than 99% of the time.

WISH: 100% of the time.

ID: QR3

TAG: ProductAvailability

DESC: The system must check availability of the products before accepting any order.

SCALE: The system must not accept order if it's not available and must notify the customer.

RAT: In order for the customer to place order

ID: QR4

TITLE: Internet connection.

DESC: The software should be connected to the internet.

RAT: In order for the application to communicate with the database.

DEP: none

ID: QR5

TITLE: GPS connection.

DESC: The system should be connected to the GPS device

RAT: In order for the system to get the users location, the map and to calculate the distance.

DEP: none

ID: QR6

TITLE: High resolution cameras.

DESC: The drone should be equipped with high resolution cameras

RAT: In order for the system to get imagery and position of drones in real time.

DEP: none

6.4.3 Maintainability

ID: QR7

TITLE: System extendibility

DESC: The system should be easy to extend. The code should be written in a way that it favors implementation of new functions.

RAT: In order for future functions to be implemented easily to the system.

DEP: none

ID: QR8

TITLE: System testability

DESC: Test environments should be built for the system to allow testing of the application's different functions.

RAT: In order to test the application.

DEP: none

6.4.4 Portability

ID: QR9

TITLE: System portability

DESC: The software system should be portable with iOS and Android.

RAT: The adaptable platform for the system to run on.

DEP: none

7. Prioritization and Release Plan

A prioritization of the requirements is required to get a view of how to split the requirements into various releases, and what specifications should be included in which release. This section addresses the choice of method of prioritization and provides a suggestion as to how the release plan would look like for those requirements.

7.1 Choice of prioritization method

For prioritization of requirements MoSCoW technique was used as it's based on expert opinion of the team and it can help us to rank and classify items in order to get a

successful product. According to the technique the list of requirements was classified into following groups.

M – Must Have

The requirements that must be satisfied in the final solution.

S – Should Have

The requirements that have high priority but are not that important to launch.

C – Could Have

The requirements that are desirable but are not that necessary.

W – Won't Have

The requirements that will not be implemented in current release but maybe in future releases.

After the classification all requirements were ranked in order of preference within every category

List of requirements can be seen in Appendix A.

7.2 Release plan

The requirements have been divided into three releases based on prioritization and dependencies. The three different releases have been assembled to function as a fully functional system.

In the first release the requirements that build up the foundation of the software system with the most highly prioritized requirements and their dependencies will be included.

The second release will include those requirements which act as additional features for improvement or enhancement of the system.

The Third release contains requirements which can be discarded if we don't have time or if we don't have enough budget to complete the project.

Further details about release plan can be seen in Appendix B.

8. Appendix A: Prioritization of requirements

ID	M	S	C	W
FR1		X		
FR2	X			
FR3	X			
FR4	X			
FR5	X			
FR6	X			
FR7		X		
FR8	X			
FR9		X		
FR10				X
FR11			X	
FR12		X		
FR13			X	
PR1	X			
PR2	X			
PR3	X			
PR4		X		
PR5		X		
PR6		X		
PR7		X		
PR8	X			
PR9	X			
PR10	X			
PR11			X	
PR12			X	
PR13	X			
SAFR1	X			

SAFR2	X			
SAFR3	X			
SAFR4	X			
SAFR5	X			
SECR1	X			
SECR2	X			
SECR3	X			
SECR4	X			
SECR5		X		
SECR6	X			
QR1	X			
QR2	X			
QR3	X			
QR4	X			
QR5	X			
QR6	X			
QR7	X			
QR8	X			
QR9	X			

9. Appendix B: Release Plan

ID	Dependencies	Description	Motivation	Release
FR1	FR2,FR3	Steering drones	This requirement is not that important for the application and can be included in the second release.	2
FR2	FR1	Assign deliveries to pilots	This is an important requirement for pilots to manage drones and should be in first release	1
FR3	FR1,FR2	Real time location data	This is an important requirement for the pilots to be able to see the sight of drones and should be included in first release	1
FR4	FR2,FR3	Checking if UAV is within define	This is an important requirement for	1

		region of operation	safety landing of the drone and should be included in first release	
FR5	none	Administer the control stations	This is an important requirement for system to administer control stations	1
FR6	none	Check product availability before accepting order	This is an important requirement as the system should only accept order if it's available	1
FR7	FR6	Send order confirmation email	This requirement is of high priority but can be included in second release	2
FR8	FR6,FR7	Dispatching packaging staff	This requirement is important as the system should be able to dispatch orders	1

FR9	none	Grouping orders together	This requirement is not that important for the application and can be included in the second release.	2
FR10	FR6	Perform statistical analysis and display graphs	This requirement is not that important but is desirable so can be included in future releases	3
FR11	FR10	Additional quality control for VIP customers	This requirement is not that important but is desirable so can be included in future releases	3
FR12	None	Send payment notification to customers	This requirement is of high priority but can be included in second release	2
FR13	FR6	Tracking and confirming an order	This requirement is not that	3

			important but is desirable so can be included in future releases	
PR1	none	Place orders	This requirement is important and should be include in first release	1
PR2	none	Receive orders	This requirement is important as the system should be able to receive orders	1
PR3	PR2, PR1	Dispatch orders	This requirement is important as the system should be able to dispatch orders	1
PR4	none	Feature to steer the drones	This requirement is not that important for the application and can be included in the second release.	2

PR5	none	Control interface for pilots	This is an important requirement for pilots to manage drones and should be in first release	1
PR6	none	See the drones	This is an important requirement for pilots to see drones and should be in first release	1
PR7	none	Operate the drones	This is an important requirement for pilots to operate drones and should be in first release	1
PR8	none	Show map to the pilots	This is an important requirement for pilots to be able to view the map	1
PR9	none	Administer control stations	This is an important requirement for system to	1

			administer control stations	
PR10	none	Shipment of orders	Shipment is a vital part of the system and should be included in first release.	1
PR11	PR10	Grouping of orders	This requirement is not that important for the application and can be included in the second release.	2
PR12	PR10	Tracking orders	This requirement is not that important for the application and can be included in the second release.	2
PR13	PR10	Accounting system	It's an important requirement related to payment and should be in first release	1

SAFR1	none	Reliability of drone control software	This will be considered and continuously improved during the whole process.	1
SAFR2	none	Stability of internet connection	Internet connection is mandatory for the application to work and is therefore included in the first release.	1
SAFR3	none	Safety landing of drone	This is an important requirement for safety landing of the drone and should be included in first release	1
SAFR4	none	Emergency landing of drone	This is an important requirement for emergency landing of the drone and should be included in first release	1

SAFR5	none	Aborting delivery	This is an important requirement as if any customer aborts the starting order all the data related to it should be cancelled as well	1
SECR1	none	Access to drocery control software	This is an important requirement in order to access drocery control software	1
SECR2	none	Secure internet connection	This is an important requirement and should be included in first release	1
SECR3	none	Create account for user	The customer is a vital part of the system and must be included in the first release.	1
SECR4	none	Create account for pilot	The pilot is a vital part of the system and	1

			must be included in the first release.	
SECR5	none	Communication security	This requirement is not that important and can be add in second release.	2
SECR6	none	Check on UAV	This is an important requirement for safety landing of the drone and should be included in first release	1
QR1	none	System reliability	This will be considered and continuously improved during the whole process	1
QR2	none	System availability	This will be considered and continuously improved during the whole process.	1
QR3	none	Product availability	This is an important	1

			requirement and should be include in first release	
QR4	none	Internet connection	Internet connection is mandatory for the application to work and is therefore included in the first release	1
QR5	none	GPS connection	GPS connection is mandatory for the application to be able to show the result and is therefore included in the first release.	1
QR6	none	High resolution camera	High resolution camera is mandatory for the application to be able to show the result and is therefore included in the first release.	1
QR7	none	System extendibility	This will be considered and	1

			continuously improved during development.	
QR8	none	System testability	The test environment for the system will continuously be built as the system expands	1
QR9	none	System portability	This will be considered and continuously improved during the whole process.	1