**43tyghRural Cultivation & Atmospheric Emulation Application (RCAEA) URS document**

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## Purpose of URS

This document is the definitive specification of the user requirements for RCAEA This document is the definitive specification of the user requirements for RCAEA Project to be developed by Tanks & Co.™The application allows the user to simulate cultivating specific crop(s) in an area of land during a certain length of time. By using this application they can determine when, where, and what crops to place in a specified piece of land. It will help the user make a cultivation plan for a certain area of land based on real land data. It considers regional factors such as weather, whereby the user can select which outdoor agricultural crops to place in an area. The simulation will use real data on the crop and simulate its growth based on external and internal determinate factors. RCAEA will take all these factors into account and determine an estimated cost and production outcome. Data will be saved in a file which the user can load or keep for their own records.

## Index

This part of the document will serve as an explanation of the terminology that will be used throughout the document the client may not be familiar with.

**Extension** – Used to describe deviations from the Main Success Scenario of a Use Case during a certain step and the alternative ways of executing the Use Case.

**Functional Requirement** – Defines a function of the application or its component. A function is described as a set of inputs, the behavior, and outputs.

**GUI** – Graphical User Interface. A type of User Interface that allows users to interact with the application through graphical icons and visual indicators such as secondary notation, instead of text-based user interfaces, typed command labels or text navigation.

**Input** – In this document is referred to the configurations the user has assigned to the application.

**MoSCoW** – **M**ust have, **S**hould have, **Co**uld have and **W**ill not have. This method is a prioritization technique used to reach a common understanding with the client on the importance that is placed on the delivery of each requirement.

**MSS** – Main Success Scenario. Used to describe the Use Cases of the application and their primary way of completion.

**Non-Functional Requirement** – A requirement that specifies criteria that can be used to evaluate the operational quality of the application, rather than specific behaviors. It is contrasted with Functional Requirements that define specific behavior or functions.

**Pre-condition** – Prerequisites needed before the Use Case can be initiated.

**Trigger** – Method of initiating the Use Case.

**URS** – User Requirements Specification. Refers to this document which specifies what the user expects the application to be able to do.

**Use Case** – A list of actions or event steps, defining the interactions between the client and the application, to achieve a goal.

# PRODUCT **DESCRIPTION**

## Background Information

SIM Software Inc. is interested in adopting simulation applications and has asked for project proposals. Tanks & Co™ has a simulation proposal and they met with a representative from SIM Software’s board of management, Mr. Johnson. He has accepted their proposal for “Rural Cultivation and Atmospheric Emulation Application”.

Mr. Johnson will be the mediator and ultimately make the decision about features of the software.

## Performance

In this project we will create an application to simulate cultivating specific crop(s) in an area of land during a user determined time period. This application will allow users to grow selected crops in a simulated field that will factor multiple variables producing approximated cost and produce over the inputted time period.

## Users

This application can be used by individual production planners as well as by multinational enterprises, primarily to strategically plan layouts, control logic and dimensions of large, complex production investments. Farmers can also use this application in order to decide which crops or mix of crops are more beneficial for them before cultivation.

## Assumptions

Following are some assumptions for this project made by us:

* Fields for cultivation are already bought by users, therefore land costs/rent will not be accounted for.
* Crop diseases will not be factored
* We assume that the weather will follow recent years’ patterns.
* We assume that crop/water/fertilizer costs, and crop selling price although seasonal will follow most recent prices.
* When crops are fully ripe/grown they will be automatically harvested.

## Constraints

* The application will be created in C# Visual Studio.
* The application will support 20 different types of crops.
* The regions available will be within The Netherlands.
* The cultivating area will be divided into 10X8 or 80 plots in total.
* Each plot can individually be adjusted between 50 and 200 ares.
* Soil selection per plot is possible.
* Simulation dates can be between 2015 and 2018.
* The end Date must be at least 3 months from start dates.
* Changes cannot be made to the simulation while it is running. The simulation must be paused before changes can be applied.
* How much Water and Fertilizer given to the crops and The Province selected are all global variables which apply to all the plots and crops.
* The Start Date, End Dates, and the can only be changed when no crops have been placed.
* Only a single plot can be selected at any given time.

# REQUIREMENTS

In the table below you can find the MOSCOW for every requirement during the project.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Requirement name | Must | Should | Could | Will Not |
| 101 | Add crops | V |  |  |  |
| 102 | Remove crop | V |  |  |  |
| 103 | Update fertilizer | V |  |  |  |
| 104 | Update water resources | V |  |  |  |
| 105 | Generate report | V |  |  |  |
| 106 | Save Report |  | V |  |  |
| 107 | Soil selection | V |  |  |  |
| 108 | Display Statistics |  | V |  |  |
| 109 | Growth simulation | V |  |  |  |
| 110 | Set Date | V |  |  |  |
| 201 | Save Simulation | V |  |  |  |
| 202 | Save As Simulation | V |  |  |  |
| 203 | Load Simulation | V |  |  |  |
| 205 | Exit Application | V |  |  |  |
| 301 | Buying/selling land |  |  |  | V |
| 302 | Renting land |  |  |  | V |
| 303 | Encounter crop diseases |  |  |  | V |
| 401 | Usability | V |  |  |  |
| 402 | Performance |  | V |  |  |
| 403 | Reliability | V |  |  |  |

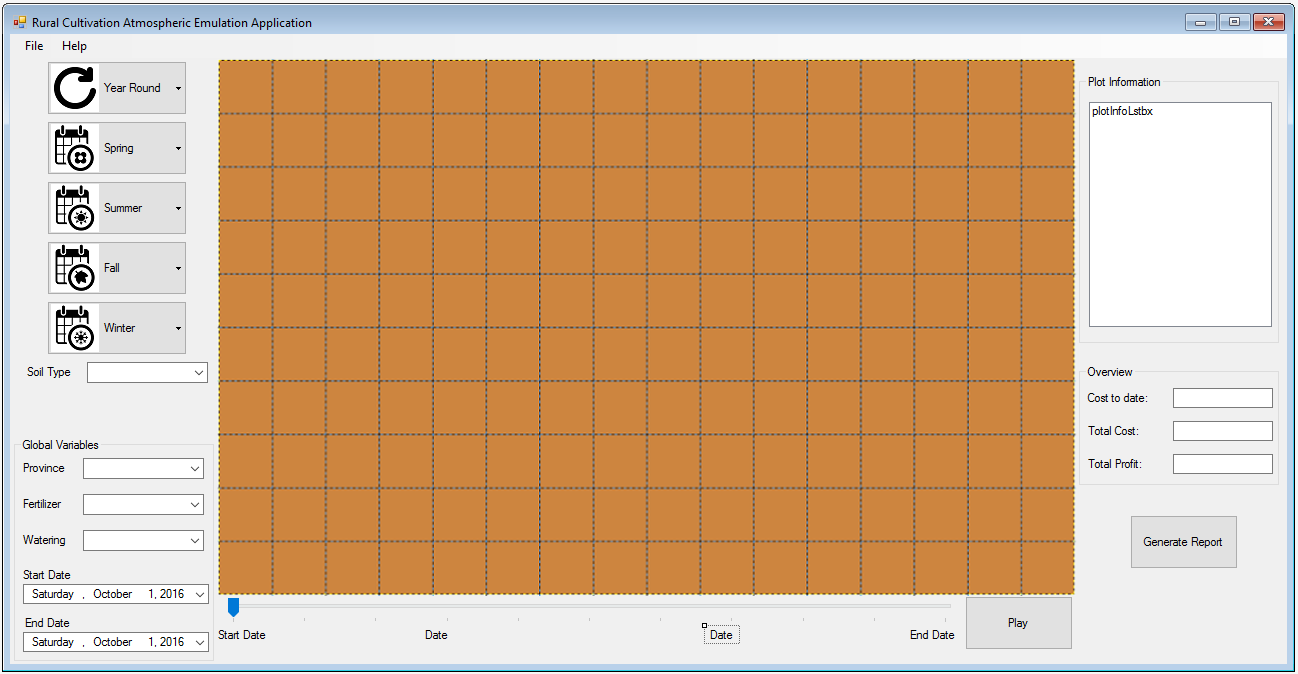
## Functional requirements

|  |  |  |
| --- | --- | --- |
| ID | Requirement name | Description |
| 101 | Add crops | Allows user to add a crop in a plot. |
| 102 | Remove crop | Will clear a plot of land of the crop previously placed. |
| 103 | Update fertilizer | User can select several options, for how much fertilizer will be given to the crops during the run time of the simulation. |
| 104 | Update water resources | The user can select several options for how much water will be given to the crops during the run time of the simulation. |
| 105 | Generate report | A report will be generated with a detailed description of all the crops involved in the simulation, also considering the overall costs, benefits/disadvantages of the current simulation. |
| 106 | Save Report | The report generated in the application will be able to be saved as a text document. |
| 107 | Soil selection | Each plot of land will have a default soil characteristic based on the region, the user can change soil properties for each plot. |
| 108 | Display Statistics | When a user selects a specific plot its statistics along with the crop added within it will be displayed. |
| 109 | Growth simulation | The growth simulation will run factoring in all the external and internal factors. |
| 110 | Set Date | The user can set the start and end date for the simulation to run. |
| 201 | Save Simulation | Will save changes to already saved simulation and all related variables and conditions into the database for later use. |
| 202 | Save As simulation | Will save the current simulation and all related variables and conditions into the database for later use. |
| 203 | Load Simulation | Will replace the current simulation with a previously saved simulation from the database. |
| 204 | Exit Application | Prompts the user if he wants to save the current simulation if he has not done so beforehand and proceeds to shut down the simulation application |
| 301 | Buying/selling land | N/A |
| 302 | Renting land | N/A |
| 303 | Encounter crop diseases | N/A |

## Non-Functional requirements

|  |  |  |
| --- | --- | --- |
| ID | Requirement name | Description |
| 401 | Usability | The application should be user-friendly and incorporate elements of good user interface design. For example, the buttons are easily recognizable and familiar to the user in terms of expressing what function they serve, making them easily accessible to the user.  The application is simplified and allows the user to reach his goal without any problems. User must be able to access the application without registration, account etc. |
| 402 | Performance | The application should respond within 1500 milliseconds with each button click, and 4000 milliseconds when loading a report on a modern machine (Processor greater than 1Ghz). |
| 403 | Reliability | In case of an exception or error, the program displays info messages without crashing, allowing the user to continue his work without disruption. |

# GUI



## GUI Details

|  |  |
| --- | --- |
| **Form’s component** | **Meaning** |
| https://lh5.googleusercontent.com/atPl_EuvMpY15fr-JuPPopKYZFO9YwhmWYl9lx7tb0hpfPd04yeLYDloq5EIqEllAfWNvIJp-mUXTKK44Nea7wuOhsMM6EXte7v44M6ShSbH0Wnvb-8GpiCvCPhvuzrrqiSx3u3Z4pBmrrBWpQ | This split button will show context menu with list of crops that can grow all round year. |
| https://lh6.googleusercontent.com/AW4FWXWj0PnQM8Vs6JF8Yf4y8oJXuaWBlvVUofpK0IL_BhQLBSDaPDIYGlQBhrVoO2cAIM938zcRiKfxvnN4cHR-N9wSwiDt57cs19vpz95bMHsHhS4LQdjceHS--jsP-ypGJWhltSxbAHEYBg | This split button will show context menu with list of crops that can grow in spring season. |
| https://lh6.googleusercontent.com/Ylrvwgye2UwKctOJZUNAmqy8jtBEyQ1UyKhetlTdwpQQTNNikLfdJPZzHpq7n_Ezi862xKMuWFmfyADuSzNJVppLWoak__1tqvPoP21ku-zvIpqR1nAiSPmPwdljXPDupMm5Pido6rdgMRQEmg | This split button will show context menu with list of crops that can grow in  summer season. |
| https://lh6.googleusercontent.com/TULD6VJIoeBrc8FwVBc0FQWXypw_pDan31hTHagfJlhovv3hNEYyc6c2x37m3NG7bG8aZ9HEcwZUbm0qKnS0LZkqDmujazd69OerKDcIa2Ky_A__Kj8LV-hMxKUlhocBJUql-4P9lZGkvgfq6g | This split button will show context menu with list of crops that can grow in autumn season. |
| https://lh3.googleusercontent.com/E4imJ3SVHReLJ0J9riVuGJv6MMRYKub1ScbAkBUKNI5Up00uD_FYg4Z1E8d7b38_JMdFTa80PG47vKMTAmrwXpXGPEZgiKWguwUfDeF-ruUcuLMybZln4op301dk5NMNG38lHXf2zIZQyQOdZQ | This split button will show context menu with list of crops that can grow in winter season. |
|  | This are two squared piece of land known as plot. Here user can add/remove and grow crops. The orange plot represents a user selected plot. |
|  | This is menu bar located on top of application. It contains File and help options. By selecting the File option you can further select saving/loading of simulation. |
| https://lh6.googleusercontent.com/5ZiXVZ6PZzS1SvOvztf9pNV_BcdXEfu9FEQGe2qRzC5yvEjJo7P_OkNWXXKoqPiHt8gZJQeEhqUrNLbVioqoNaw8ASkbmVVlb7PO6Kqf-jSaq2rDyhquE59JeHj4lLmj37i4PBnoI1N5nu2niA | Soil type selection drop-down box (per plot). |
| https://lh4.googleusercontent.com/KkU3ZWJt6M0GxPUqRXKkYpRpHQ_Smhk4jnqCnLcXPw9NT_cFfu17hBaelGzJOVBGcbaGG8CLkmftHpuKRpfbuIh3LvyCutEfQ4FU8sTHNeT9WXExsVbslLoGBQKpZqjNoedMqAvRSyLpZfW99A | Global variable selection drop-down boxes for current simulation.  Province dropdown for selecting the location of the field within the confinements of the Netherlands. Every province will have different weather and soil properties.  Fertilizer dropdown for selecting how much fertilizer will be used during the run time of the simulation.  Watering dropdown for selecting how much water will be used during the run time of the simulation. |
| https://lh3.googleusercontent.com/h9UoMIK1rNPP7xfBkIbKRNtS9k3GVKnmcXfVXy041Ba2661AbEFRccDy74sYgknMZqj0cWOd2-A2bqHbUKItiulkbo-EV6jLx7acwAy-76htmjgYh5ngrxiUp2bsrqZTxm1B6pRz_DMr7IpVzA | These selectors will be used to set start and end date of a simulation. |
| https://lh3.googleusercontent.com/5aGjaqemTRqW8sV6OXYFYjyFT8LHnEFTMluPErjy1_K967lRrNDmi-kbBvwAzD8JVgWS1yDY4hKfhq_UFGEwfHEU8MlSqYtsgeKtMT-I4PWQGF6MYNdSkwSbmqQCGwzDL2H5jyCQ2VPbNmhTGQ | These text fields display cost to date, total cost and total profit of the current simulation. |
|  | This progress bar can be used to move across the timeline of the simulation depending on the start and end date selected. |
| https://lh4.googleusercontent.com/GDIpbQnIXPKtRMJRDE8HyRzY8PrqrmDWdSeLuIyNG90ZVRbtBbrfcTRj1BEL6BXePtR0Ao3OMRup-YxYajDBMsA7wPnwZxxq6yB3POt_oOVu2O42P8ggr7RoD0S9aH096tOp0c0DTu-SLZmDbg | This button will make the simulation automatically, it will act also as the stop/pause button during simulation runtime. |
|  | This is plot information panel that will show details for selected plot . |
| https://lh4.googleusercontent.com/L6FvZbnWbngJ1hLLnO8swig4E96Ds-gGdAWOPn2BTlggbDjd8VQh_kJ_tgjj3xFMdoUvl2RyovZtAtoyGf-b4aq9Bs5p8ro0GE_wAs9db-J-nTqKJ1f6dfvE3YSNNjBReMG218sL5Sy57MB8Qg | This button will generate an overall report about current simulation. |
|  | This panel is the Overview panel that shows the costs until current time in the simulation and the total cost and profit of the entire simulation. |
|  | This is the size of the plot where a user can change the size of a selected plot by Ares. (1 Ares = 100 squared meters) |

# USE CASES

All use cases have the system and user as the only actors involved. Furthermore, all the use cases are of the sea-level.

### 101: Adding crops

**Pre-condition:** The screen must have at least one field not cultivated with crops.

**MSS:**

1.    User clicks on a crop category button.

2.    System displays the available crops from that category.

3.    User selects a specific crop.

4.    System shows the selected crop in the crop selection box.

5.    User double clicks the plot where he wants to cultivate.

6.    System updates the land plot with the type of that crop.

**Extensions:**

         5a. Land space is already occupied by another crop.

               1. System displays a warning box to the user to prompt if it should replace the old crop.

a. User clicks yes.

1. Use-Case continues to step 6.

b. User clicks no

1.Use-Case ends.

### 102: Removing crops

**Pre-condition:** The screen must have at least one field cultivated with crops.

**MSS:**

1.    User will double right click on the plot he wishes to delete.

2.    System deletes the crop from the plot.

**Extensions**

1a. The selected plot is an empty plot.

* 1. Use Case Ends

### 103: Updating fertilizers to crops

**Precondition:** The simulation must be set at the start of the time frame or paused if it was previously running.

**MSS:**

1.    User will click on the fertilizer drop down menu.

2.    System will display the fertilizer drop down options.

3.    User will click on the amount of fertilizer he wants from the drop down options

4.  System will update the current fertilizer quantity used.

### 104: Updating water resources

**Precondition:** The simulation must be set at the start of the time frame or paused if it was previously running.

**MSS:**

1.    User will click on watering drop down menu.

2.    System will display the watering drop down options

3.    User will click on one of the amount of water in drop-down options.

4.System will update the current watering quantity used.

### 105: Generate report

**Pre-condition:** The screen must have at least one field, cultivated with crops.

**MSS:**

1.    User clicks on the Generate Report Button

2.    System opens second windows form, displaying the report.

**Extension:**

      2a. System has errors in generating the report.

         1. System will display notification box describing the error.

               2.User clicks ok.

         3.System closes the newly created windows form.

         4.Use-Case ends.

### 106: Save Report

**Pre-condition:** The screen must have at least one field, cultivated with crops, and the User has already generated a report.

**MSS:**

1. User clicks on Save Report button.
2. System Opens a Save Dialog field.
3. User inputs a filename and the location.
4. User clicks save.
5. System creates a text document and saves the report in the desired location.

Extension:

3a. Filename already exists

a. System prompts the user that the filename already exists and asks if they wish to overwrite.

1a. User clicks they wish to overwrite

a. System overwrites file with the same name, and saves the text file.

1b. User clicks no.

a. User renames the filename.

b. Use Case to 4.

1c. User clicks cancel

a. System closes save dialog.

b. Use Case ends

### 107: Soil Selection

**MSS:**

1. User clicks on plot.
2. System with display current plot soil type in soil type drop down box.
3. User clicks on drop down arrow on soil type drop down box.
4. System Displays soil type options.
5. User selects one of the drop down box options.
6. System sets soil type of selected plot.

### 108: Display statistics

**Pre-condition:** The screen must have at least one field, cultivated with crops.

**MSS:**

1. User selects a plot

2. System displays statistics for the selected plot in the plot information panel with Crop information if any, or states that the plot is empty.

### 109: Simulating growth of crops:

**Pre-condition:** The screen must have at least one field, cultivated with crops. Start Date and end date are filled.

**MSS:**

1.    User clicks start simulation.

2.     System changes the start button to stop button.

3.     System disables crops selecting buttons and watering/fertilizer/soil selection dropdown options.

4.     System runs simulation from beginning to end.

**Extension:**

      1a.    User scrolls on the timeline bar.

    1.    System actively runs simulation accordingly to the timeline bar position.

      3a.     User clicks stop button

                1.System stops running simulation

     2.System changes stop button to start button.

3.System will enable crop selecting buttons and watering/fertilizer/soil selection

dropdown options.

4.Usecase ends.

      3b.     System gets an error

           1.System stops running simulation.

      3c. User has not entered Start and End date.

         1.System will display notification that start and/or end date has not been entered.

                  2.Use-Case Ends.

### 110: Selecting start date and end date

**MSS:**

1.    User selects start date selector.

2.   System displays small calendar with possible dates.

3.   User selects a start date.

4.   System closes small calendar

5.   System updates the selected date into the start date field.

6.    User selects end date selector.

7.   System displays small calendar with possible dates.

8.   User selects an end date.

9.   System closes small calendar

10. System updates the selected date into the end date field.

11.  System updates the timeline of the progress bar with the new start and end date.

**Extensions:**

        8a. User selected end date is less than 3 months from the selected starting date

1. System displays a pop-up message.

2. Use-Case continues from step 6

8b. User selected end date is more than 3 years from selected starting date

1. System displays a pop-up message

2. Use-Case continues from step 6

### 201: Save simulation

**Pre-condition:** The user has the current simulation saved already and made new changes on it.

**MSS:**

1.    User clicks on “File” from menu bar.

2.    System displays ”File” options.

3.    User selects “Save” option.

4. System saves the new changes.

### 202: Save As simulation

**Extend:**204 Exit application

**MSS:**

1.    User clicks on “File” from menu bar.

2.    System displays “File” options.

3.    User selects “Save As” option.

4.    System brings up the list from database.

5.    System saves data and simulation in the database.

**Extension:**

3a. User Selects data to overwrite by choosing already used file name

              1.   System will ask user to confirm overwriting file.

                      a.    User confirms

                           i.     System connects to database and finds the current instance of the file to overwrite

                           ii.     System deletes the current instance of data located in the database.

                           iii.     Use-Case continues from step 3

                      b.    User cancels overwriting

* 1. Use-Case ends

### 203: Loading simulation

**MSS:**

1.    User clicks on File from menu bar.

2.    System displays File options.

3.    User selects load option

4.   User see a pop-up window from where browse the simulation file, select the file and click on open

5.    User see the loaded simulation

**Extensions:**

4.a User clicks on a different file rather than a simulation file and click open

       1: User get a pop-up message about the inappropriate file format

       2: Continue from step 2 in MSS.

### 204: Exit application

**Pre-condition:** The user has the main form of the RCAEA app open on his PC.

**Trigger:** User will click on the close button of the main form.

**MSS:**

1. System prompts users asking if he wants to quit the application.
2. User clicks “Yes”.
3. System closes application.

**Extensions:**

1a System prompts users asking if he wants to save before quitting the application

1. Reference to 202 Saving simulation

2a User clicks “Cancel”

1.Use case ends.

# APPROVALS

### Sign-off Sheet