**Problem analysis**

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| **Client:** | * Cali’s mayor’s office |
| **Users:** | * Public officials |
| **Functional requirements:** | * Req#1: Register a community. * Req#2: Register a place. * Req#3: Add a product to a community. * Req#4: Delete a product from a community. * Req#5: Add a species in a place. * Req#6: Modify a species data in a place. * Req#7: Access the information from a place. * Req#8: Access the information of the communities in a department. * Req#9: Access the information of communities based on their biggest problematic. * Req#10: Display the name of the place with the most species diversity. * Req#11: Display the three places with the biggest area. |
| **Context of the problem:** | * The 16th edition of the UN’s Climate Change Conference of the Parties (COP) is an important event to address the conservation of biodiversity and ecosystems. This year, the event is being held in Cali this year and for the reason, the Mayor’s Office is looking to make a program that will let them register, organize, and keep track of the biodiverse places, the communities that take care of those places, and the products the communities sell. * The public officials should be able to utilize the program to save information of these biodiverse places (and their species), communities and products. Additionally, the program should allow them to consult, modify or eliminate information depending on the type of data. Lastly, the program should allow the consultation of the most diverse place and the top three with the biggest area. * The program should be able to work with two separate menus (administrative and consultation). It should be able to be manipulated by multiple users at a time, be organized and be able to handle a big amount of information. |
| **Nonfunctional requirements:** | * Interoperability: The program should be able to handle multiple users at a time. * High usability: The program should use a menu that makes it easy to understand while entering, editing, or consulting information. * High availability: The program should be working 24/7 and outage risks mitigated. |

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| **Identifier and Name:** | Req#1: Register a community. | | |
| **Summary:** | The system allows the user to register a new community by adding a name, type, representant’s name, representant’s phone number, population, and greatest challenges. At the start, the product inventory is an empty array of 20 elements that will be filled as the program progresses so it’s not an input. The community type and the greatest challenges options will be displayed so the user can pick one of each. If the community is registered correctly, a message stating that the process was successful will print. On the other hand, if the community that is trying to be registered already exists, there is any error from unknown cause, there is invalid information or incomplete information the appropriate message will be displayed. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Name | String | * Character > 2 * Can’t be repeated from the other communities already registered. * Mandatory |
| Type | Community Type | * Must be one of the following options:   + Afro Colombian   + Indigenous   + Raizal * Mandatory |
| Representant’s Name | String | * Character >2 * Mandatory |
| Representant’s Phone Number | String | * Character == 10 * Mandatory |
| Population | Int | * Int > 0 * Mandatory |
| Greatest Challenges | Challenge | * Must be one of the following options:   + Absence of hospitals   + Lack of schools   + Inadequate access to clean water   + Insufficient access to food |
| **Results or postcondition** | The program allows the user to register a new community using the name, type, representants name, representants phone number, population, and greatest challenges. The system will create an array of 20 empty spaces to later fill with the community’s product inventory (data type product[]). In order to register the enumeration like community type and greatest challenge the possible options will be printed for the user to choose from. The system will also check if the name of the entered community already exists inside the product array. Afterwards, a message of success will appear. In case the community is not registered a message of error, incomplete information or invalid information will print depending on the situation. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Success | String | A message stating that the community was registered successfully will be printed. |
| Duplicate Community | String | A message saying that the community that is trying to be added already exists will pop up. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the community to be registered will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#2: Register a place. | | |
| **Summary:** | A user can register a new biodiverse place after entering the name, department, area, type, inauguration date, photo, caregiving community’s name, and economic resources. The present species in the place at the beginning is an empty array with 50 elements that will be filled as the program runs. In order to select the caregiving community, a small menu displaying all the registered communities will be shown so the user enters one option. Before registering a place, the system will check if there are duplicates (displaying a “duplicates” message in case there are). If the place is registered correctly, a message stating that the process was successful will pop up. On the other hand, a message of error, incomplete information or invalid information will be printed depending on the cause of the error. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Name | String | * Character > 2 * Mandatory |
| Department | Department | * Must be one of the following options:   + Choco   + Valle   + Cauca   + Nariño * Mandatory |
| Area | Double | * Double > 0 * Mandatory |
| Type | PlaceType | * Must be one of the following options:   + Protected area   + National Park   + Private area |
| Inauguration date | Date | * dd-mm-aaaa * Mandatory |
| Photo | String | * URL of the selected image * Only one image * Mandatory |
| Caregiving Community’s  Name | int | * Can only be one of the preregistered communities. * Mandatory |
| Economic Resources | Double | * Double > 0 * Mandatory |
| **Results or postcondition** | The place is registered with all the mandatory information: Name, department, area, type, inauguration date, photo, caregiving community’s name, economic resources. First, the system will search for duplicates, if there are any, a “duplicate message” will be thrown. Afterwards, it will create an empty array with 50 spaces to fill with the species that are present in the area (data type Species[]). The name of the possible registered caregiving communities will be displayed for the user to choose one from in the form of an int. If done correctly, a message of success will be printed. If there are any errors, the appropriate messages of error, incomplete or invalid information will de be printed. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Success | String | A message stating that the place was registered successfully will be printed. |
| Duplicate place | String | A message saying that the place that is trying to be added already exists will pop up. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the place to be registered will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#3: Add a product to a community. | | |
| **Summary:** | A product can be registered by a user to a community if the community’s name, product name, natural materials percentage, type and handcraft condition are entered completely and correctly. The system will check if the community that the product is trying to be assigned to exists. The system will also check that there is space to add a new product and if the product name already exists. To enter a product type, a small menu showing the options for both states will be printed for the user to choose from. After a product is created and associated to a community, it will show a message stating that the product was registered successfully. If any error were to appear, the error message, incomplete information or invalid information will be printed depending on the root of the error. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Community name | String | * The name is extracted from one of the preexisting communities already created. * Mandatory |
| Product name | String | * Characters > 2 * Mandatory |
| Natural materials percentage | Double | * Double between 0 and 100 * Mandatory |
| Type | ProductType | * Must contain one of the following options:   + Food   + Craft * Mandatory |
| Handcraft condition | String | * Only options are:   + Yes   + No * Mandatory |
| **Results or postcondition** | To register a new product, it needs to be associated to a community, so the name of the community should be extracted to check if it exists or not. Additionally, the system will also check if there is space to save a new product and if the name of the entered new product already exists. To add a product, the user must the name of the product, natural materials percentage, the type, and the handcraft condition. After, If the community exists, there is space in the array, and no product duplicates are present, the user enters all the necessary information, a printed message will say a new product has been added to the community. Otherwise, a message of error, no space, duplicate product, nonexistent community, incomplete information, or invalid information will be printed depending on the cause. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Added New Product | String | A message stating that the product was created and then registered successfully to a community will be printed. |
| No space for new product | String | A message stating that the entire array has been filled and there is no more space to register any other product will be printed. |
| Duplicate product | String | A message saying that the product that is trying to be added already exists will pop up. |
| Nonexistent community | String | A message showing that the entered community is not registered yet will be shown. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the product to be registered will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#4: Delete a product from a community. | | |
| **Summary:** | For a user to eliminate a product from a community he will enter the community’s name and the product name so the system can find the product in the community and delete it. The system will check that the community’s name and the product’s name exist to proceed (if they don’t the appropriate message will be printed). If the product is eliminated, a success message will pop up. Alternatively, an error, incomplete information or invalid information message will print in case the product couldn’t be eliminated. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Community Name | String | * The name should already make part of one of the preexisting communities in the system. * Mandatory |
| Product Name | String | * The name should already make part of one of the preexisting products in the system. * Mandatory |
| **Results or postcondition** | After the user inputs the community’s name and the product, the system will check if the community and the product within the community exist. In the case the community or the product within the community are not registered, then a nonexistent community or product message will pop up. If both exist, then it will erase the product from the inventory of the community and a success message will be printed. If there are any errors, an error message, an incomplete information, or an invalid information will be printed. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Success | String | A message stating that the product was successfully eliminated form a community will be printed. |
| Nonexistent community | String | A message saying that the entered community doesn’t exist will be printed. |
| Nonexistent product | String | A message showing that the entered product is not registered within the community will be shown. |
| Error | String | A message stating there was an error of unknown cause that didn't allow product to be deleted from the community will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#5: Add a species in a place. | | |
| **Summary:** | A user can register a species as long as he enters the place’s name, species’ name, type (which will be entered using a small menu), photo, and local population count. The system will validate if the place exists, that there is space for a new product and that there are not any duplicates of the species saved. After the validations a message stating that a new species was added will be printed. On the other hand, if any of the validations go wrong, a message showing that the community doesn’t exist, that there is no more space for a new species or that the species already exists will be printed. If there are any other type of errors a message displaying that an error of unknown cause, incomplete information or invalid information didn’t allow the process to continue normally. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Place’s name | String | * The name should already make part of one of the preexisting places in the system. * Mandatory |
| Species’ name | String | * Character > 2 * Mandatory |
| Type | SpeciesType | * Must select one of the following options:   + Flora   + Fauna * Mandatory |
| Photo | String | * URL of the selected image * Only one image * Mandatory |
| Local population count | Int | * Int > 0 * Mandatory |
| **Results or postcondition** | The system will allow the user to add a species to a place if the place exists, the species is not duplicated and there is space to enter a new species. Then, the user must input the place name and the species name to check the conditions above. The other information to associate a new species is a photo, and the local population count must be added. In case of the species type, a small menu showing the two possible options will be printed for the use to use from. After the user enters all the necessary information, a message that a new species has been added to a Place. If any of the validations go wrong, the no space, the duplicate species the nonexistent community will be printed. If there was any other source of error, the appropriate message of error, incomplete information or invalid information will be printed depending on the situation. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Added New species | String | A message stating that the species was created and then registered successfully to a place will be printed. |
| No space for new Species | String | A message stating that the entire array has been filled and there is no more space to register any other species will be printed. |
| Duplicate species | String | A message saying that the species that is trying to be added already exists will pop up. |
| Nonexistent place | String | A message showing that the entered place is not registered yet will be shown. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the species to be registered to a place will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#6: Modify a species data in a place. | | |
| **Summary:** | The user will be able to modify the species’ information inside a community by first entering the place’s name and the species name to check if those even exist. If neither of those two exist, a nonexistent community or species message will be printed. The system will need to check if the new species name is not duplicated with any other registered species’ name. If the validation step passes, the information that wants to be changed should be entered (Species name, type, photo, and/or local population count). To change the species, type a small menu with the two options that will be used to enter the information. If the information is modified, a success message will be printed showing the information that was changed. If the information couldn’t be modified, the system will show a message of error, incomplete information or invalid information depending on what caused the error. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Place name | String | * The name should already make part of one of the preexisting places in the system. * Mandatory |
| Old species name | String | * The name should already make part of one of the preexisting species inside a place in the system. * Mandatory |
| New species name | String | * Characters > 2 * Optional |
| Type | SpeciesType | * Must select one of the following options:   + Flora   + Fauna * Optional |
| Photo | String | * URL of the selected image * Only one image * Optional |
| Local population count | Int | * Int > 0 * Optional |
| **Results or postcondition** | The system should allow the user to enter the name of a preexisting species inside a preexisting place so the information can be modified. If neither of those exist, a nonexistent community or species will be printed. Additionally, if the user wants to change a new species name, it will be checked if that name isn’t already registered (it will throw another duplicate message). Afterwards, the user must enter the values of the variables he wishes to change (Type, Photo, and/or local population count). The type of species will be selected via a small menu that will show the two available options. Next, the program shows a message of success showing that the information of the species inside the place was modified. In other cases, the message of error, incomplete information or invalid information will be printed. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Success | String | A message stating that the information of a species inside a place was modified correctly will be printed. |
| duplicate species | String | A message saying that the new species name that is trying to be modified already exists will pop up. |
| Nonexistent place | String | A message showing that the entered place is not registered yet will be shown. |
| Nonexistent species | String | A message showing that the entered name of the species is not registered yet will be shown. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the information of a species inside a place be modified will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#7: Access the information from a place. | | |
| **Summary:** | For the system to print all the information from a place, the user must enter the place’s name. Next, the existence will be checked and in case it doesn’t exist a nonexistent place message will be shown. If the name does match with one of the registered place’s names, then the entire information of the place will be printed. If the information is not printed, an error message, incomplete information message or invalid information message will be printed depending on the source of the error. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Place name | String | * The name should already make part of one of the preexisting places in the system. * Mandatory |
| **Results or postcondition** | After the user enters the name of the place, the system will check first that the name is already registered (if it’s not, a nonexistent place message will be printed). If the place’s name does exist, the system will display all the information that is stored about that place. If the information is not printed, a message of error, incomplete information or invalid information will be printed instead (depending on the situation). | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Place information | String | The entire information of a place will be printed. |
| Nonexistent place | String | A message showing that the entered place is not registered yet will be shown. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the information to be printed |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#8: Access the information of the communities in a department. | | |
| **Summary:** | For the user to retrieve all the information of all the communities in one department, first, he will need to provide the name of the department. Second, the system will check that the department’s name provided does exist, showing a nonexistent department message in case the name doesn’t match any of the registered departments. After the system finds the information, it will print the data of every community without duplicating the information of a community in case it takes care of more than one place. If the department was empty, it would be an “empty” message. Alternatively, if the information was not printed, then an error, incomplete information or invalid information will be printed. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Department name | Department | * Must select one of the following options:   + Choco   + Valle   + Cauca   + Nariño * Mandatory |
| **Results or postcondition** | The system will print out all the information (grouped by community) about all the communities that are inside the selected department. If there entered name of the department doesn’t exist a nonexistent department message will appear. If the community does exist, it will gather all the information of every community and display it (without showing any duplicates). On the other hand, if the selected department doesn’t have any community inside, then an empty error message will pop up. If the information can’t be printed, it will show a message of error, incomplete information, or invalid information depending on the cause of the error. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Community information | String | The entire information of the communities that are registered inside the same department will be printed. |
| Nonexistent Department | String | A message showing that the entered department doesn’t make part of the considered group by the system. |
| Empty department | String | A message stating that the entered department doesn’t contain any communities will be printed. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the information to be printed will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#9: Access the information of communities based on their biggest problematic. | | |
| **Summary:** | Firstly, it's designed to print out all information grouped by community, particularly highlighting areas facing challenges “absence of hospitals” and “lack of schools schools”. Before proceeding with the printing process, it verifies if both challenges do have any community confronting this challenge (if not, an empty message will be printed under the empty challenge). Should any errors arise during the printing process, the system provides appropriate feedback. This includes messages indicating an error, incomplete information, or invalid data, depending on the specific issue encountered. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| Main problematic | Challenge | * Must select one of the following options:   + Absence of hospitals   + Lack of schools |
| **Results or postcondition** | The system will print out all the information (grouped by community) about all the communities that show either of those main problematics (absence of hospitals or lack of schools). If both of the mentioned challenges don’t make part of the communities registered in the program, an empty challenge message will be printed. If the information can’t be printed, it will show a message of error, incomplete information, or invalid information depending on the cause of the error. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Community information | String | All the information stored about the communities that had the selected problematic registered, will be printed. |
| Empty challenge | String | A message showing that there is no community that is going through “lack of schools” and/or “absence of hospitals” within the program will be printed. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the information to be printed will be printed. |
| Incomplete information | String | A message stating that not all the mandatory fields where filled will be printed. |
| Invalid information | String | A message stating that there are mistakes in the inputted information (don’t follow the conditions) |

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| **Identifier and Name:** | Req#10: Display the name of the place with the most species diversity. | | |
| **Summary:** | When the user selects the option of consulting the name of the place with the most species, the system will extract and print the name of the place with the most diversity (highest number of species registered). If the name is not printed, an error message will be printed instead. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| N/A | N/A | N/A |
| **Results or postcondition** | The system will use the information stored of every place and then compare which has the most registered species. Afterwards it will order it and print the name of the most diverse place. If the name is not printed, a message of error will appear. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Most diverse place | String | A message stating that the place was registered successfully will be printed. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the place to be registered will be printed. |

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| **Identifier and Name:** | Req#11: Display the three places with the biggest area. | | |
| **Summary:** | The system will allow the user to see which are the top three places with the biggest area (in km2) by printing it. If any error occurred in this process, the error message would be printed in this case. | | |
| **Inputs** | **Input name** | **Data Type** | **Conditions for valid values** |
| N/A | N/A | N/A |
| **Results or postcondition** | The system will compare the area information of the registered places, organize it, and print the names of the top three places with the biggest area. If all the places had the same area (or any population count number is repeated), it would choose the first 3 that come in order. If the names are not printed, a message of error will appear. | | |
| **Outputs** | **Output Name** | **Data type** | **Format** |
| Success | String | A message stating that the place was registered successfully will be printed. |
| Error | String | A message stating there was an error of unknown cause that didn't allow the place to be registered will be printed. |