Land Optimizer

Group 3

Group 3 : Software Engineering Project

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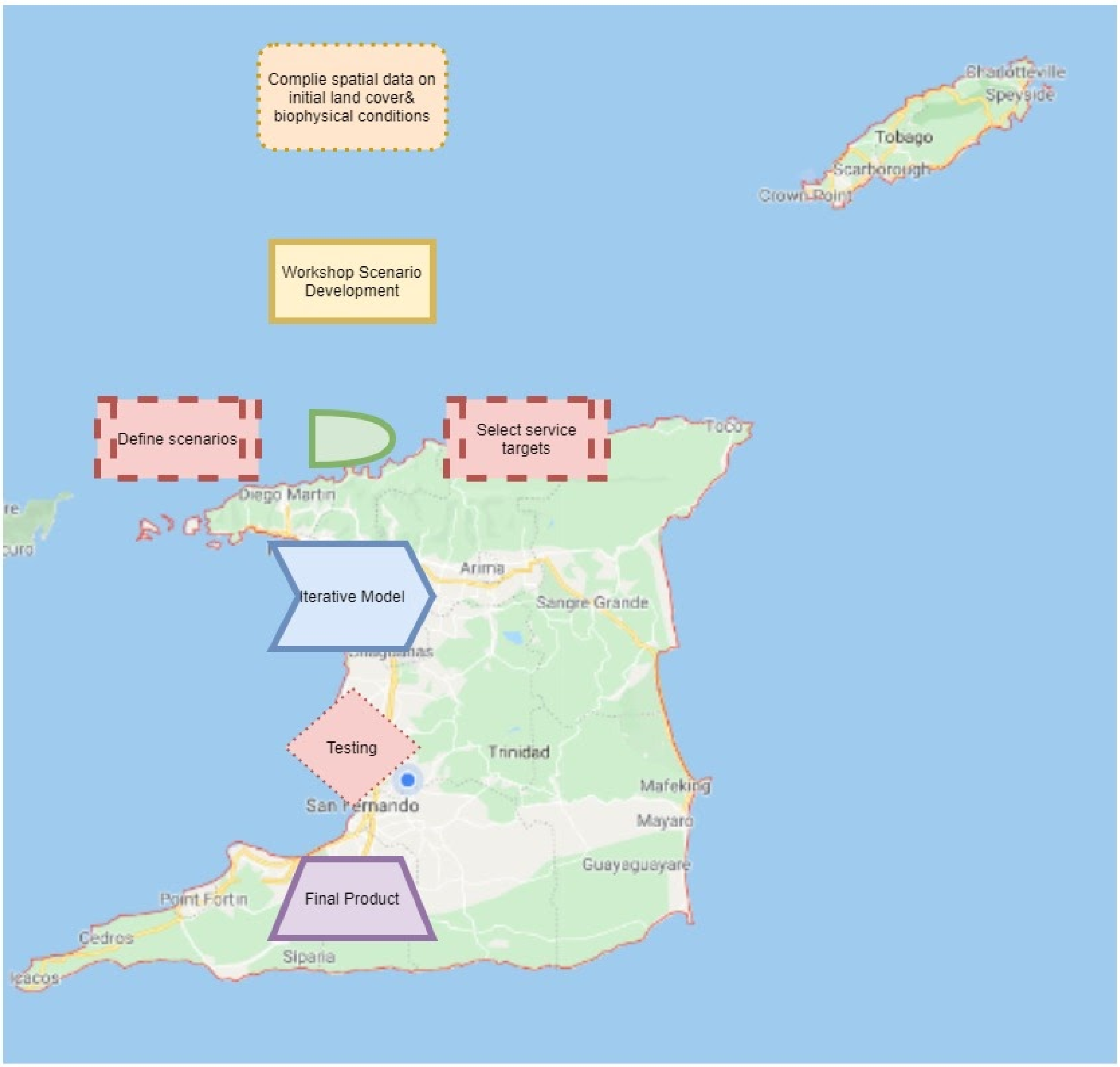

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Testing Plans

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Table 1.3 : Black Box Test for selectSuitableLand method

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Risk Management

Table 2.0 identifies risk and minimizes the impact on the software project.

Interface

Image 1.0 showing the homepage of the user interface.

Image 1.1 showing the land selecting tool when generating a land model.

Image 1.2 showing the 3D model of the land schematics.

Image 1.3 showing the login page for the user interface.

Image 1.4 showing the interface used by the manager to add new managers or add new employee profiles to the software. This essentially gives each employee their own work space.

Introduction

Problem:

This project aims to explore the optimal layout of urban development whilst considering accessibility, connectivity, density, smart growth and sprawl. Our aim is to find a solution for urban sprawl within the constraints of the building codes and standards in Trinidad and Tobago, in cases where these ideas cannot be collated we will seek solutions in new emerging technologies. Land use is a critical problem facing islands since it is a non-renewable resource that is in high demand. This problem impacts centralization, pollution, and agricultural issues not only for Trinidad and Tobago but other tropical island states as well.Essentially we intend for our software to output a best case scenario with both statistical and design information.

The human population between 1950 and 2050 is projected to approximately quadruple and shift from 80% rural to nearly 80% urban (UN 2011). The majority of this growth occurs in developing countries like Trinidad and Tobago. How developing countries accommodate for the rise in population and increase in urbanization will have a huge economic, social and environmental impact. In order to minimize urban sprawl, have a positive social and economic effect while minimizing environmental degradation is a challenge we face right now. An optimal solution is needed to keep in line with population growth, climate change and the new environmental goals outlined by the world leaders.

Goals/Aims of System:

- Creates sustainable and affordable housing for future generations.
- Creates job opportunities in construction.
- Ultimately tries to optimize transportation by facilitating multiple road types.

Target User:

- Government of Trinidad and Tobago,
- Construction Companies,
- Environmental Companies,
- Private sector
- Ministry of Urban Development
- Architects
- Small Business Owners

Requirements

User Requirements

The user privileges should be differentiated from a manager privileges. Users can only view their work where as a manager can add or remove employees and views everyone's work; they are also able to access all the regular functionality of the program.

The optimal layout for buildings in an area of land. The user should be able to employ a sandbox feature. The time taken for the computation of a problem is done efficiently.

The user would like current data concerning the area of land they hope to parcel. They would click View Schematica Database. The user would input the light pole number or address. Information about utilities and various landmarks will be presented.(See relevant diagram)

The user wants a sandbox feature to create, update, delete and orient buildings for a fixed piece of land.

The user requires a select feature that can be used with a map of Trinidad and Tobago to build a diagram of the selected area.

The user will input information to influence the building size.

System Requirements

The system shall generate a report upon request of the employee.

The report shall include a checklist of documents.

The system should allow for restricted building areas with an Environmental Management Authority approved buffer zone.

The system shall produce multiple optimized solutions.

The system will determine spacing for various utilities depending on the building size.

The system will determine the building size.

The system will allocate generous road space to capacitate the amount of vehicular traffic expected by the population size.

The system will allocate areas necessary for water treatment and waste disposal depending on the expected population size.

Functional Requirement

1. The system shall have authenticated user login.
2. The system shall register a new user account.
3. The system shall save the work done by registered users.
4. The system should provide a search function arranged by street name or nearest light pole number.
5. The system should allow users to enter the shape and dimensions of the plot of land.
6. The system shall be able to generate a building size or allow the user to enter the preferred size of house.
7. The system should display an interactive map of Trinidad and Tobago and allow the user to select the area of land to be developed.
8. The system should consist of cropping and cutting tools to assist in the selecting and editing of a piece of land.
9. The system shall be able to calculate the maximum number of houses that can fit on said plot of land.
10. The system shall create a report containing a summary of the building specifications generated.
11. The system should generate a 3D graphical model of the building schematics and utility infrastructure for the land dimensions specified by the user.The system should compute results with consideration to the building codes and standards set by the local government (Trinidad and Tobago).
12. The system will generate a range of results for the optimal use of land.
13. The system shall generate an error message if the user attempts to plot on water or mountainous regions on the map.
14. The system will generate an error message if there is a necessary field left blank.
15. The system should offer the user to select the preferred units of measurements.
16. The system will prompt the user at the initialization of the application to view tutorials and videos on how to accomplish specific tasks.

Non-functional Requirements

1. The system shall respond in a timely fashion to any request.
2. The system shall be scalable with regards to the addition of more maps and different countries' building codes and standards in the future.
3. The system shall be scalable with regards to addition of more complex and customised shapes of land.
4. The system should be operable on computer and mobile platforms.
5. Language is available in English and Spanish, and addition of more languages can be implemented.

Diagrams

Context Model

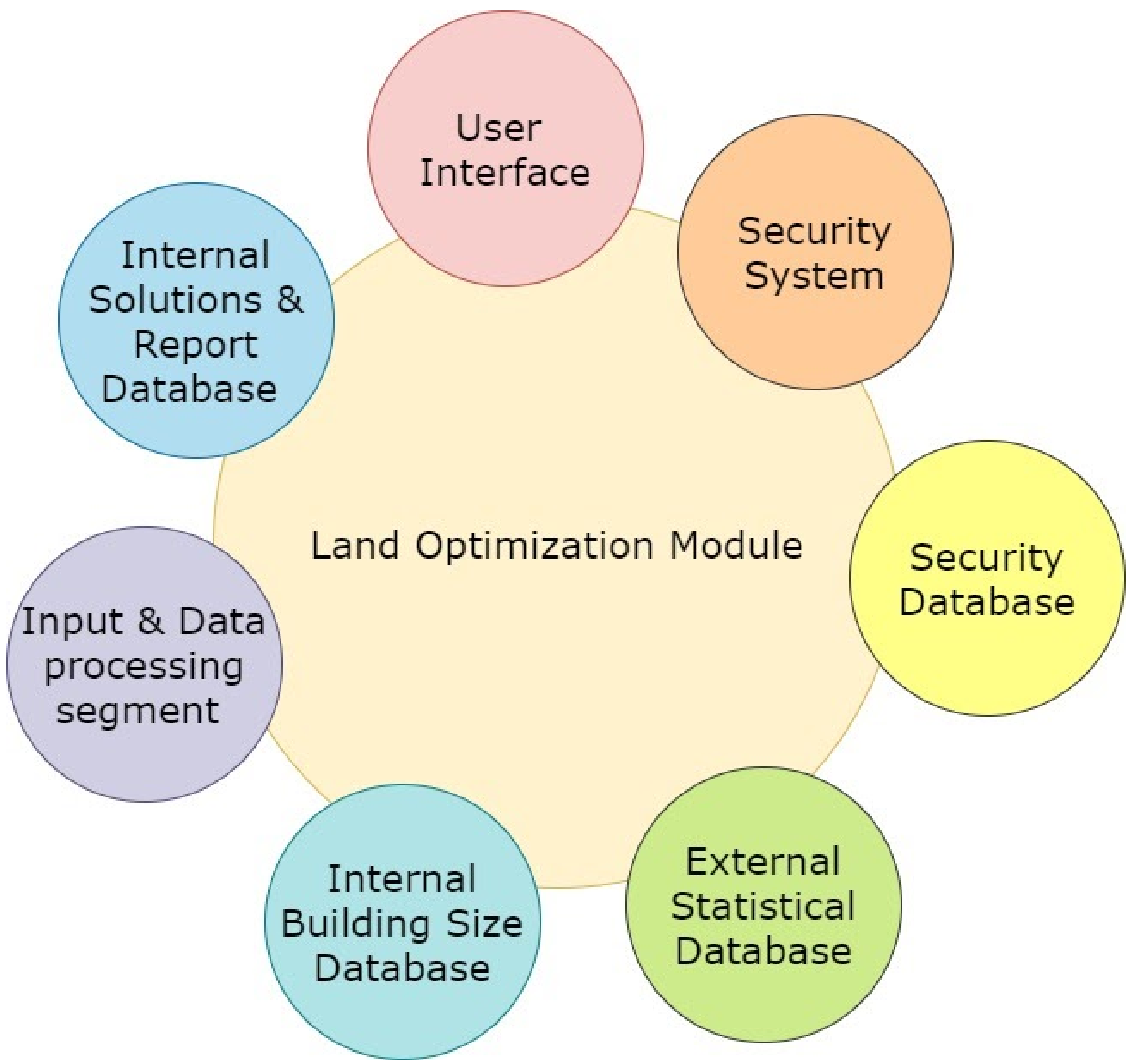


Diagram 1.0 Of a context model illustrating the connectivity of the related databases and computing segments.

Use Cases

Simple Use case

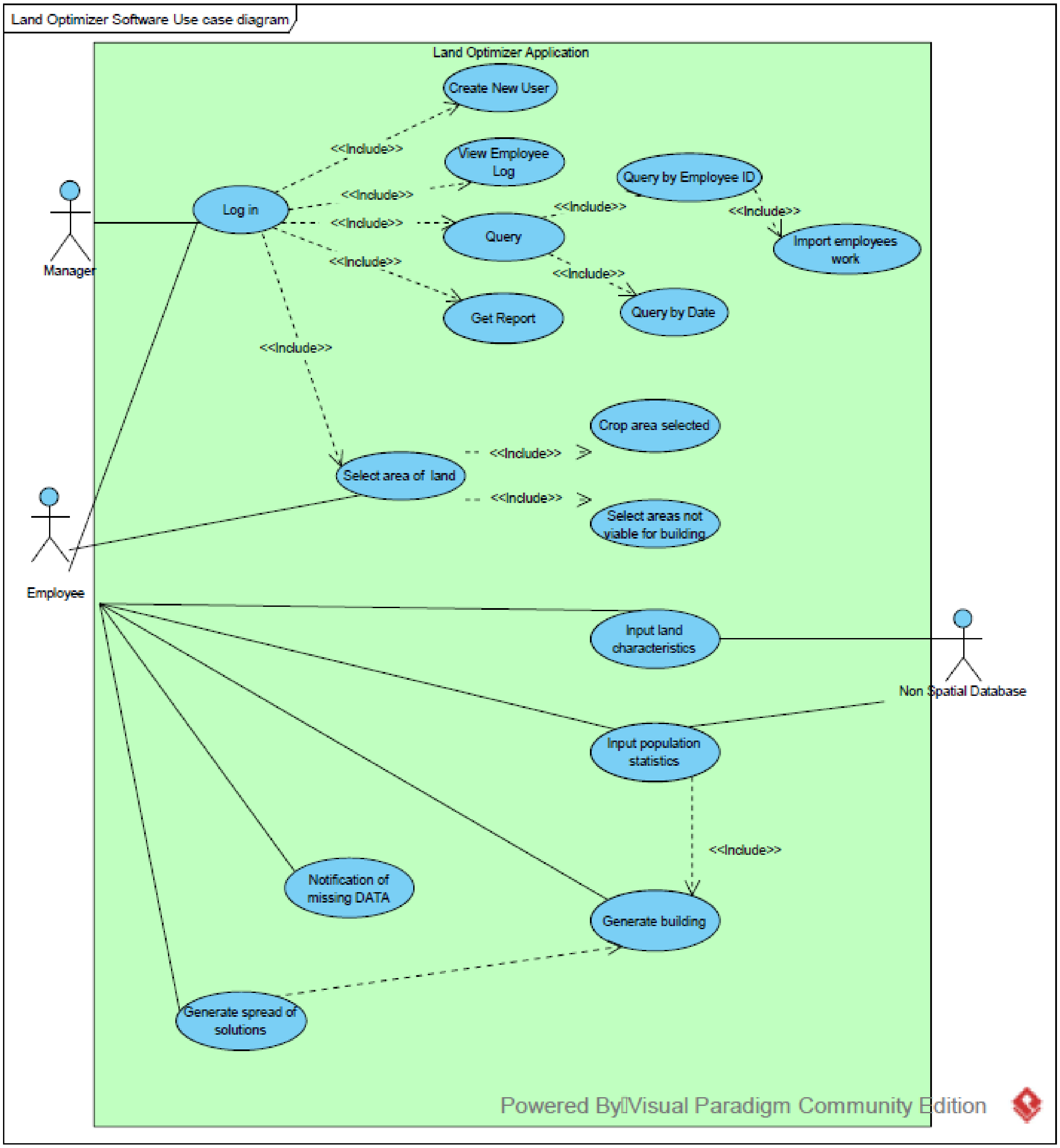


Diagram 2.0 illustrates a simple use case scenario with interactions among actors and external databases.

Ranking

Evaluates use cases on a scale of 1-5 against 6 criteria.

1. **Significant impact on architectural design.**
2. **Easy to implement but contains significant functionality.**
3. **Includes risky, time-critical, or complex functions.**
4. **Involves significant research or new or risky technology.**
5. **Includes primary business functions.**
6. **Will increase revenue or decrease costs.**

Use - Case Name	Ranking Criteria, 1 to 5						Total score	Priority	Build Cycle
	1	*2*	*3*	*4*	*5*	*6*			
Login	2	3	1	1	2	1	10	Low	2
Create New User	2	3	1	1	2	1	10	Low	1
View Employee Log	3	3	1	2	3	2	14	Medium	2
Query	2	3	1	3	3	3	15	Medium	3
Get Report	3	3	2	2	4	4	18	Medium	3
Select area of land	5	5	3	3	3	3	22	High	1
Input land characteristics, population capacity and preferences	4	5	2	3	3	3	20	Medium	3
Generate building	5	4	2	4	2	2	19	High	1
Notification of missing data	1	3	1	1	1	1	8	Low	3
Generate spread of solutions	5	3	5	5	5	5	28	High	1

Diagram 2.1 Ranking of use case scenarios to determine the priority of diagrams.

Expanded Use Case

Author(s):Fazeeia Mohammed

Use-Case Name:	New User registration	Use case type Business Requirements:
Use-Case ID:	Use-Case 1	
Priority:	1	
Source:	Functional Requirements 1	
Primary Business Actors:	Manager, Employee	
Other Participating Actors:	External Database	
Other Interested Stakeholders:	Environmental Management Authority. Town and Country Planning Division Services.	
Description:	The use case describes the event of adding a new user to the software application. The manager is able to add employees as users into the system.	

Precondition:	The software is installed on a system that fits all the system requirements and is booted in the Managers profile.
Trigger:	This use case is initiated when the manager selects “add new employee” from the drop down menu.

<table>
<tr><td>Typical Course of Events:</td><td>
<table>
<tr><th>Actor Action</th><th>System Response</th></tr>
<tr><td>Step 1:The manager provides the system with a Username for the new account along with other user information.</td><td>Step 2:The system responds by verifying that all the required information has been acquired.

Step 3:The system determines what functions are available to the user and ensures that the user is not allowed to access any other accounts.</td></tr>
<tr><td>Step 4:The new user types in his or her username.(initial login)</td><td>Step 5: The system prompts the user for a password longer than 8 characters.</td></tr>
<tr><td>Step 6:
The user inputs a password.</td><td>Step 7:The system stores the password for future use.The system outputs “New User Registered”</td></tr>
</table>
</td></tr>
<tr><td>Alternate Course:</td><td>Alt Step 1: The manager does not provide a username or vital user information.The manager is notified of the discrepancy and is prompted to submit a username.
Alt Step 4: The new user misspells or types in a username that does not exist. The system responds with invalid username.
Alt Step 6: The user does not enter a password or enters a password under 8 characters. The system prompts the user to enter an eight character password.</td></tr>
<tr><td>Conclusion:</td><td>The use case concludes when the system outputs “New User Registered”.</td></tr>
<tr><td>Post-condition:</td><td>The new user is now part of the system and has limited access to the application.</td></tr>
<tr><td>Business Rules:</td><td></td></tr>
<tr><td>Implementation Constraints and Specifications:</td><td>The GUI and interface for registering a new user is provided.</td></tr>
</table>

Assumptions:	**The new user added is a registered employee of the organization.All employees are given the same amount of functionality regardless of rank except for the manager.**
Open Issues:	**Need to determine what functions “employees” or new users are allowed.**

Diagram 2.2 Expanded Use Case new user registration.

Author(s):Roganci Fontelera

Use-Case Name:	Generate a range of results for the optimal use of land.	Use case type: Business Requirements:
Use-Case ID:	Use-Case 3	
Priority:	High	
Source:	Functional Requirements 1	
Primary Business Actors:	Manager, Employee	
Other Participating Actors:	External Database	
Other Interested Stakeholders:	Management	
Description:	The use case describes the event of generating optimal models for a given land. The user's desired land development type, population capacity, building type preference and custom specifications are inputted to be analysed and generate optimal potential models.	

Precondition:	The user has completed login authentication and an instance of land dimensions and shape has been selected.	
Trigger:	This use case where the shape and dimensions of the plot of land has been submitted.	
Typical Course of Events:	Actor Action	System Response
	Step 1: The user inputs the land development type, desired population capacity, prefered	Step 2: The system responds by

	building type and the building code for the land.	verifying that the building type selected is coherent with the development type selected. Step 3: The system verifies that the building type for the given land dimension could accommodate the desired population capacity. Step 4: The system checks if the buildings have sufficient land space for utility infrastructure. Step 5:The system generates possible custom utility infrastructure specifications which could be added onto building code.
	Step 6: The user selects prefered utility infrastructure specifications.	Step 7:The system responds by incorporating the custom utility infrastructure specifications. Step 8:Once the specifications are processed, the system generates land schematics and 3d graphical model.
Alternate Courses:	Alt-Step 2: The user has not provided coherent building type for selected development type. The user is notified of the discrepancy and is prompted to resubmit the building type. Alt-Step 3: The land and building type cannot facilitate the desired population capacity. The use is notified of the discrepancy and prompted to lower the population capacity.	
Conclusion:	The use case concludes the user receives the land schematics and model file.	
Post-condition:	The user has a document of the 2D land schematics and editable 3D model.	
Business Rules:	Land Schematics based on the accepted building code of Trinidad and Tobago.	

Implementation Constraints and Specifications:	**The computer system specifications impact on 3d model rendering time.**
Assumptions:	**The size of land available is contiguous.**
Open Issues:	

Diagram 2.3 Expanded Use Case that generates a range of results for land optimization.

Author(s):Rongzhen Chen

Use-Case Name:	Enter shape and dimensions of land	Use case type Business Requirements:
Use-Case ID:	Use-Case 2	
Priority:	High	
Source:	Functional Requirements 1	
Primary Business Actors:	Manager, Employee	
Other Participating Actors:	External Database	
Other Interested Stakeholders:		
Description:	This use case describes the event of a user entering data - shape and dimensions. Once the data is entered, the system will then prompt for house dimensions and then finally generate the results, which is a 3D model of the building schematics and related utilities.	

Precondition:	The user has completed log-in authentication.

<table>
<tr><td>Trigger:</td><td>This use case is initiated when the user clicks on the link "Enter Shape and Dimensions of plot of land"</td></tr>
<tr><td>Typical Course of Events:</td><td>
<table>
<tr><th>Actor Action</th><th>System Response</th></tr>
<tr><td>Step 1: The user selects the preferred units of measurements.

Step 2: The user types in the shape of the land and its dimensions in the appropriate fields and then presses Enter.</td><td>Step 3: The system responds by verifying that all required information has been provided.

Step 4: The system verifies that the data is not invalid i.e. dimensions are too small, smaller than the minimum house dimensions

Step 5: Once all data is verified, the system proceeds to the next process, generating a building size or prompting the user to input building dimensions.</td></tr>
</table>
</td></tr>
</table>

Alternate Course:	**Alt-Step 1: The user does not select any measurement. The default unit is metre.** **Alt-Step 3: The user has left a field/fields blank. The user is notified and prompted to fill in the missing field/fields.** **Alt-Step 4: The user enters inappropriate data e.g. putting a shape in the Dimensions field and vice-versa or putting invalid symbols. The user is notified of the invalid entry and prompted to re-enter data.**
Conclusion:	**This use case concludes when the user is taken to the next process - Building Dimensions**
Post-condition:	**The data entered is kept by the system for use in calculations and report generation.**
Business Rules:	
Implementation Constraints and Specifications:	**GUI must be provided for users.**
Assumptions:	**The new user added is a registered employee of the organization.All employees are given the same amount of functionality regardless of rank except for the manager.**
Open Issues:	**Need to determine the appropriate type of input for dimensions depending on the shape of land (rectangle, square,....etc)**

Diagram 2.4 Expanded Use Case which allows the user to enter shape and dimensions of land.

Sequence Diagram

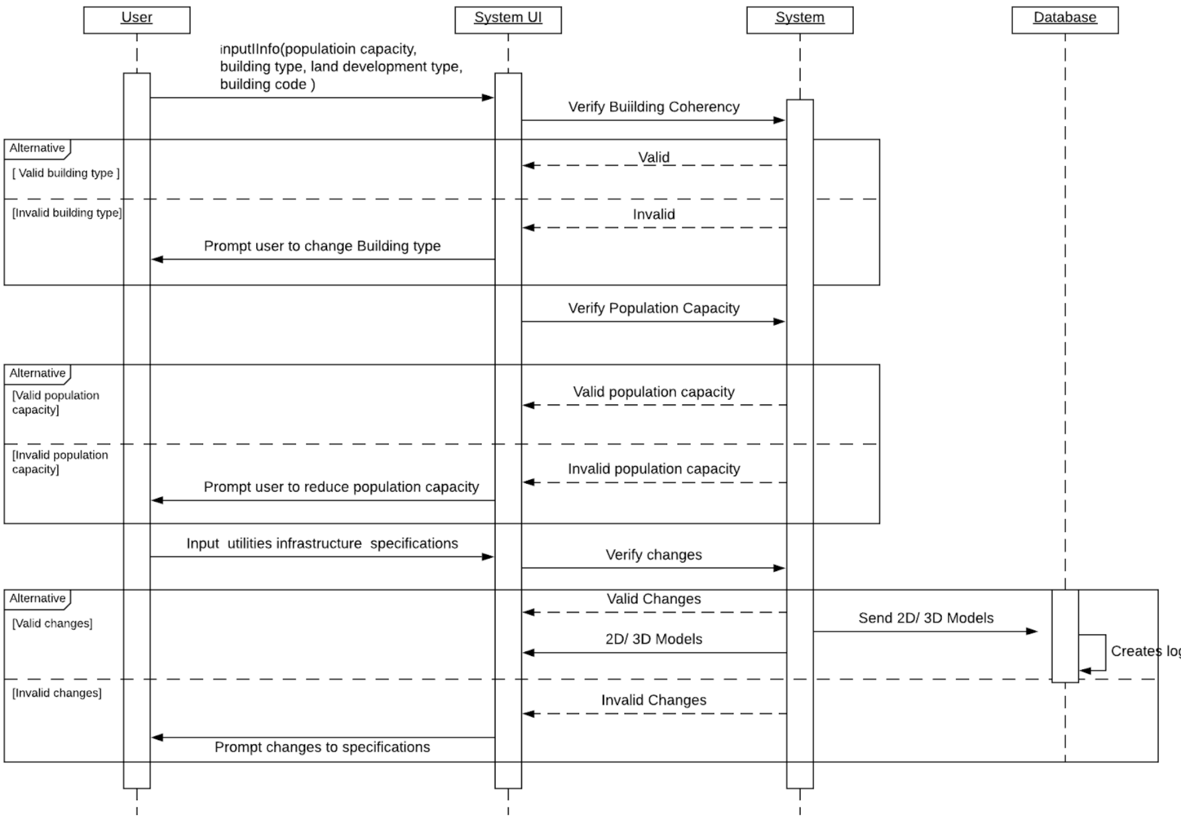
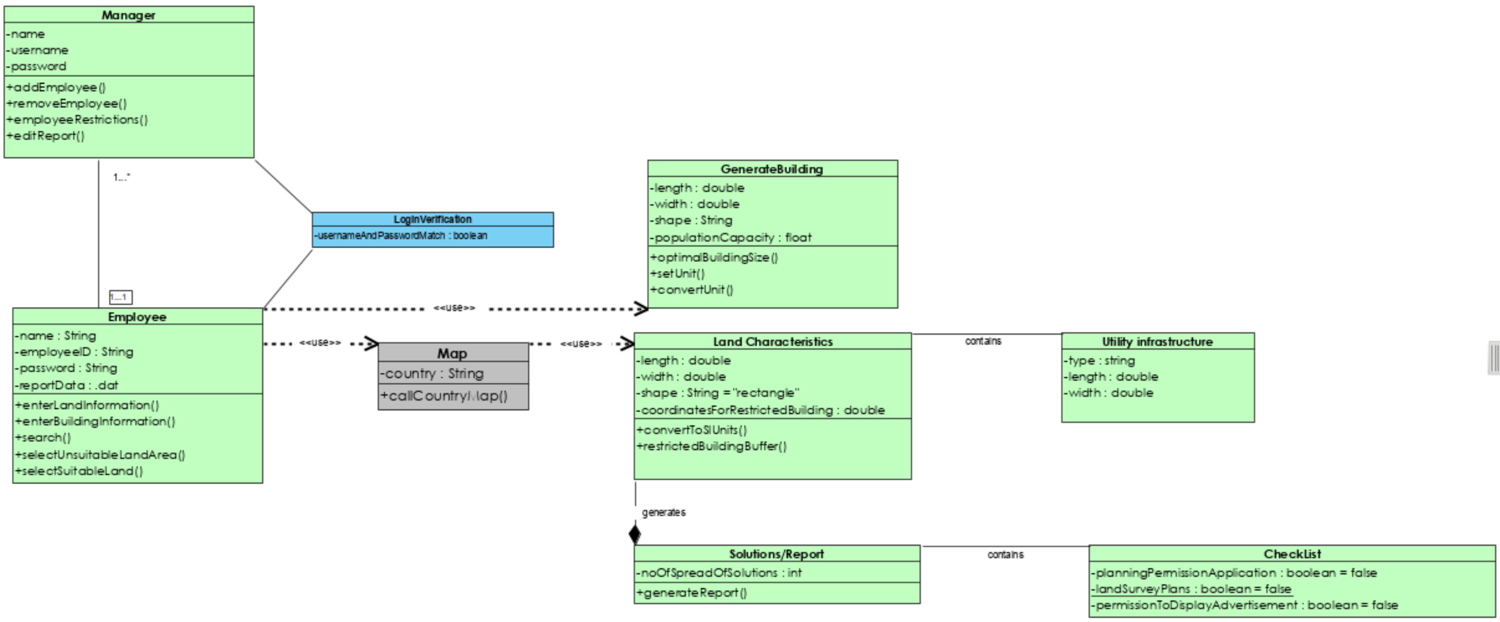


Diagram 3.0 illustrating the input of data to generate a report and 3d models.

Class Diagram



Testing Plans

Test 1

Method: addEmployee

Description of Method:

This method allows a manager to add a new employee account to the system.

Criterion:
- User must be signed in
- User must be a manager

Valid Class:
- Employee account does not exist.

Invalid Class:
- Employee account exists already.

Boundary:
None

Test Case	Input Type	Input	Expected Output
1	Valid	Employee account does not exist	Notify user that account creation is successful
2	Invalid	Employee account exists	Notify user that account cannot be created because it exists already

Table 1.0 : Black Box Test for addEmployee method

Test 2

Method: enterLandInformation

Description of Method:

This method allows an employee to enter the dimensions and shape of the plot of land to be generated.

Criterion:
- User must be signed in
- User must be an employee on the system

Valid Class:
- A form with valid shape and a plot size equal to or greater than the minimum.

Invalid Class:
- A form with missing data/invalid shape/plot size less than the minimum.

Boundary:
The minimum space requirement for one house as regulated by the country's building codes.

Test Case	Input Type	Input	Expected Output
1	Valid	All fields completed and all input is valid	The software moves on to the next page - enterBuildingInformation
4	Invalid	A field has been left blank	Notify user of missing field and prompt to enter data
5	Invalid	Invalid shape entered	Notify user of invalid shape prompt to re-enter shape
6	Invalid area < minimumArea	Dimensions too small	Notify user of the minimum plot size and prompt to re-enter dimensions

Table 1.1 : Black Box Test for enterLandInformation method

Test 3

Method: enterBuildingInformation

Description of Method:

This method allows an employee to enter the preferred size of building.

Criterion:
- User must be signed in
- User must be an employee on the system

Valid Class:
- A form with building size equal to or greater than the minimum and an appropriate population capacity.

Invalid class:
- A form with missing data or mismatched building size and population capacity.

Boundary:
The minimum house size as regulated by the country's building codes.
The maximum population capacity for a certain building size as regulated by the country's building codes.

Test Case	Input Type	Input	Expected Output
1	Valid	The necessary fields are completed with valid data	The software moves on to the next stage - generating the 3D model
2	Invalid	A field has been left blank	Notify user of missing field and prompt to enter data
3	Invalid area < minimumArea	Size of building insufficient	Notify user of the minimum building size and prompt to re-enter data
4	Invalid	Population too large for particular building size	Notify user and prompt to re-enter either population size or building size

Table 1.2 : Black Box Test for enterBuildingInformation method

Test 4

Method: selectSuitableLand

Description of Method:

This method allows the user to select a plot of land from the interactive map.

Criterion:
- User must be signed in and be an employee.

Valid Class:
- The selected land is on appropriate terrain suitable and permitted for development.

Invalid Class:
- The selected land is on inappropriate terrain e.g mountain, water or not permitted for development.

Boundary:

Selected area must be within the map.

Test Case	Input Type	Input	Expected Output
1	Valid	The selected land is on terrain suitable for development	The software saves the characteristics of the land and moves on to the next stage - enterBuildingInformatio n
2	Invalid	The selected land is on inappropriate terrain	Notify user of inappropriate terrain and allow user to select again
3	Invalid	The selected land does not permit development	Notify user of prohibited development and allow user to select again

Table 1.3 : Black Box Test for selectSuitableLand method

Test 5

Method: convertUnit

Description of Method:

This method allows the user to change the preferred units of measurement for building dimensions.

Criterion:

- The user is signed in and an employee

Valid Class:
- The selected unit is different to the one already applied

Invalid Class:
- The selected unit is the same as the one already applied

Boundary:

None

Test Case	Input Type	Input	Expected Output
1	Valid	The selected unit is imperial	The displays and calculations for all measurements are converted from metric to imperial
2	Valid	The selected unit is metric	The displays and calculations for all measurements are converted from imperial to metric
3	Invalid	The selected unit is imperial	Notify user that measurements are already imperial
4	Invalid	The selected unit is metric	Notify user that measurements are already metric

Table 1.4 : Black Box Test for convertUnit method

Acceptance Testing

Final testing must be done by potential end users in order to test whether all the requirements are met. We will be employing some of the target audience of this system to perform the tests - architects, land-owners, housing development managers, land surveyors and more.

- There will be a list of acceptance criteria made which aims to test all the use case scenarios. Acceptance tests will be made according to those criteria.

- The acceptance tests are then given to users to run in an environment where test data can be observed in real time.
- The test results are recorded and analyzed, comparing them to the expected results.
- Based on the test results, decisions can then be made on how the project will proceed such as whether to accept, reject, or make alterations.

Risk Management

<table>
<tr><td colspan="2">Risk:
The time required to develop the software is underestimated.</td><td colspan="2" rowspan="3">Strategy:
Investigate buying-in components</td></tr>
<tr><td>Affects:</td><td>Project</td></tr>
<tr><td>Probability:</td><td>High</td></tr>
<tr><td>Effects:</td><td>Serious</td><td>Strategy Type:</td><td>Avoidance</td></tr>
<tr><td colspan="2">Risk:
Organizational financial problems force reductions in the project budget</td><td colspan="2" rowspan="3">Strategy:
Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business and presenting reasons why cuts to the project budget would not be cost effective.</td></tr>
<tr><td>Affects:</td><td>Project</td></tr>
<tr><td>Probability:</td><td>Low</td></tr>
<tr><td>Effects:</td><td>Catastrophic</td><td>Strategy Type:</td><td>Minimization</td></tr>
<tr><td colspan="2">Risk:
It is impossible to recruit staff with the skills required for the project.</td><td colspan="2" rowspan="3">Strategy:
Alert customers to potential difficulties and the possibility of delays; investigate buying-in components.</td></tr>
<tr><td>Affects:</td><td>Project</td></tr>
<tr><td>Probability:</td><td>High</td></tr>
<tr><td>Effects:</td><td>Catastrophic</td><td>Strategy Type:</td><td>Minimization</td></tr>
<tr><td colspan="2">Risk:
Changes to requirements that require major design rework are proposed.</td><td colspan="2" rowspan="3">Strategy:
Derive traceability information to assess requirements change impact; maximize information hiding in the design.</td></tr>
<tr><td>Affects:</td><td>Project and product</td></tr>
<tr><td>Probability:</td><td>Moderate</td></tr>
<tr><td>Effects:</td><td>Serious</td><td>Strategy Type:</td><td>Minimization</td></tr>
</table>

<table>
<tr><td colspan="2">Risk:
The database used in the system cannot store as many reports, schematics and 3D models as expected.</td><td colspan="2" rowspan="3">Strategy:
Investigate the possibility of buying a storage capacity database.</td></tr>
<tr><td>Affects:</td><td>Product</td></tr>
<tr><td>Probability:</td><td>Moderate</td></tr>
<tr><td>Effects:</td><td>Serious</td><td>Strategy Type:</td><td>Avoidance</td></tr>
<tr><td colspan="2">Risk:
The external company that supplies statistical and utilities mapping goes out of business</td><td colspan="2" rowspan="3">Strategy:
Investigate alternative service providers; Notify management that investment into an internal surveying team to provide this data.</td></tr>
<tr><td>Affects:</td><td>Project and project</td></tr>
<tr><td>Probability:</td><td>Moderate</td></tr>
<tr><td>Effects:</td><td>Catastrophic</td><td>Strategy Type:</td><td>Minimization</td></tr>
<tr><td colspan="2">Risk:
The physical database is corrupted or severely damaged due to natural disasters.</td><td colspan="2" rowspan="3">Strategy:
Have a cloud database which backups all the schematic and models periodically.</td></tr>
<tr><td>Affects:</td><td>Product</td></tr>
<tr><td>Probability:</td><td>Low</td></tr>
<tr><td>Effects:</td><td>Serious</td><td>Strategy Type:</td><td>Avoidance</td></tr>
<tr><td colspan="2">Risk:
Key staff are ill at critical times in the project</td><td colspan="2" rowspan="3">Strategy:
Reorganize the team so that there is more overlap of work and people therefore understand each other’s jobs.</td></tr>
<tr><td>Affects:</td><td>Project</td></tr>
<tr><td>Probability:</td><td>Moderate</td></tr>
<tr><td>Effects:</td><td>Serious</td><td>Strategy Type:</td><td>Minimization</td></tr>
</table>

Risk: The underlying technology on which the system is built is superseded by new technology.		Strategy: Investigate new technology open source to build upon or buy in components .	
Affects:	Business		
Probability:	High		
Effects:	Catastrophic	Strategy Type:	Minimization
Risk: Software tools cannot be integrated		Strategy: From the research process, use runner up software tools.	
Affects:	Project		
Probability:	High		
Effects:	Tolerable	Strategy Type:	Avoidance

Table 2.0 identifies risk and minimize the impact on the software project.

Cost Estimation

The cost estimation model that will be used for this project is the COCOMO II (Constructive Cost Model). This algorithmic model is used because its utilization of historical data makes it a reliable and accurate form of estimation. It is also easy to use and interpret, helping developers to better understand how it works. It accounts for many factors that would affect the cost of a project, especially with the cost driver attributes. This model provides a transparent working environment and is better tuned for modern software life cycles that will evolve over time.

A COCOMO II online calculator is used for this estimation. The sizing method used is SLOC.

SLOC: 40,000 **Cost per Person-Month**: TTD$30,000

Results

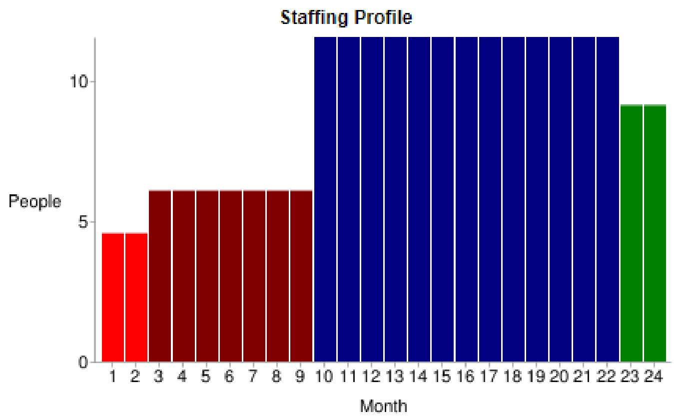
Software Development (Elaboration and Construction)

Effort = 201.1 Person-months
Schedule = 21.1 Months
Cost = $6031963

Total Equivalent Size = 40000 SLOC

Acquisition Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	12.1	2.6	4.6	$361918
Elaboration	48.3	7.9	6.1	$1447671
Construction	152.8	13.2	11.6	$4584292
Transition	24.1	2.6	9.1	$723836



Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	1.7	5.8	15.3	3.4
Environment/CM	1.2	3.9	7.6	1.2
Requirements	4.6	8.7	12.2	1.0
Design	2.3	17.4	24.4	1.0
Implementation	1.0	6.3	52.0	4.6
Assessment	1.0	4.8	36.7	5.8
Deployment	0.4	1.4	4.6	7.2

Figure 5.0: Results of COCOMO II calculation

The average amount of lines of code is 40000. This is a fair estimation based on the comparison of the leading competition. The estimated cost was determined to be $6,031,963 with a schedule of 21.1 months. This is expected since the application takes into consideration many different features geared specifically to a tropical developing country. The cost is indeed high but given the complex functions that it must perform, it requires heavy coding and testing. This includes the integration of an interactive map that must be translated into a grid that the software can process. The system must be able to generate a large 3D model with buildings and utilities that can be interacted with.

A software application like this can be incredibly beneficial for a wide host of people. Urban planning will be made more convenient with the visual aids and statistical reports generated. Use of this application is expected to be heavy, increasing marginally due to prospective population growth and urbanization. This software also has positive environmental implications because it displays efficient ways to fit the most number of people in a limited space.

Interfaces

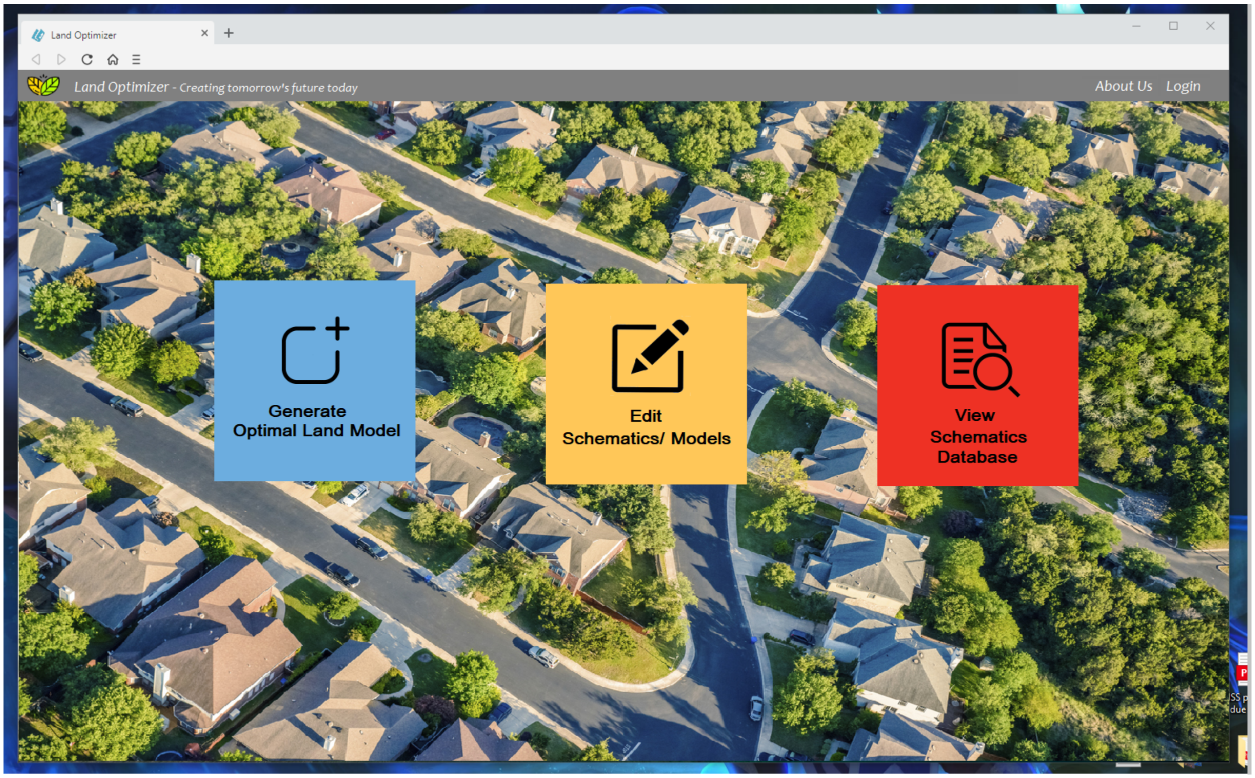


Image 1.0 showing the homepage of the user interface.

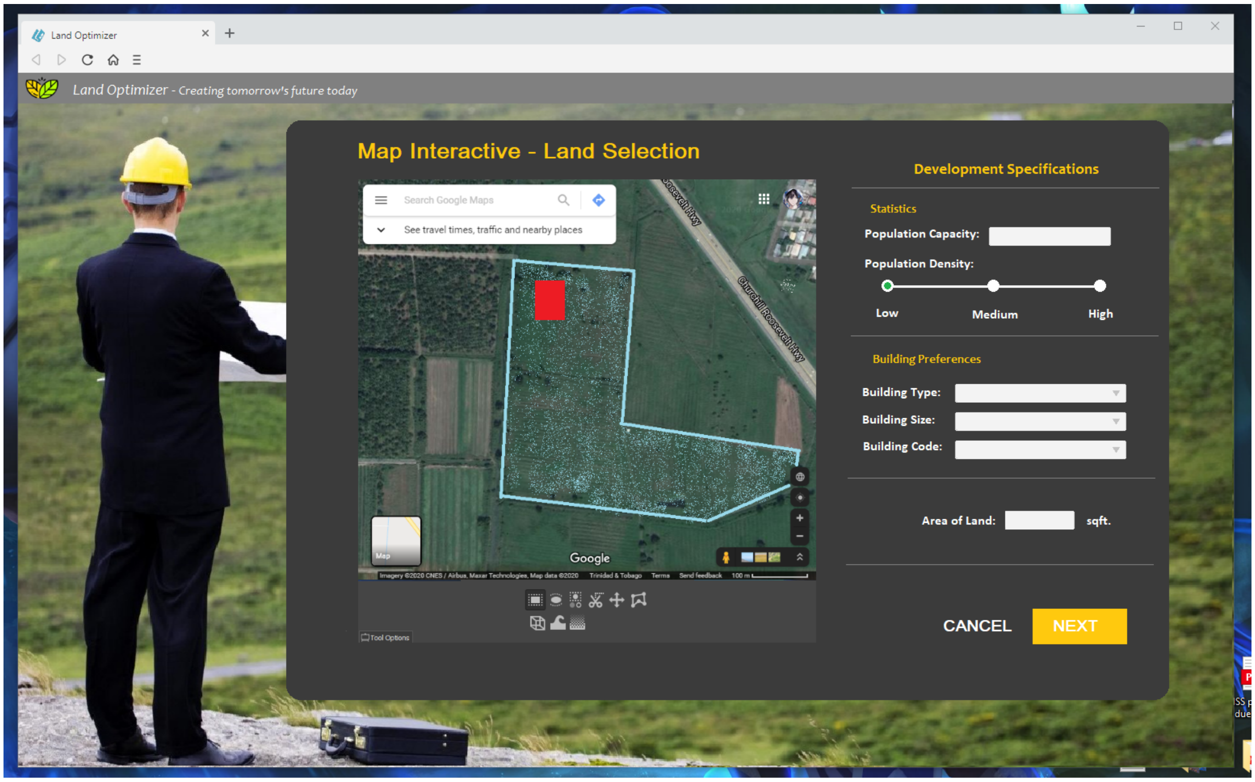


Image 1.1 showing the land selecting tool when generating a land model.

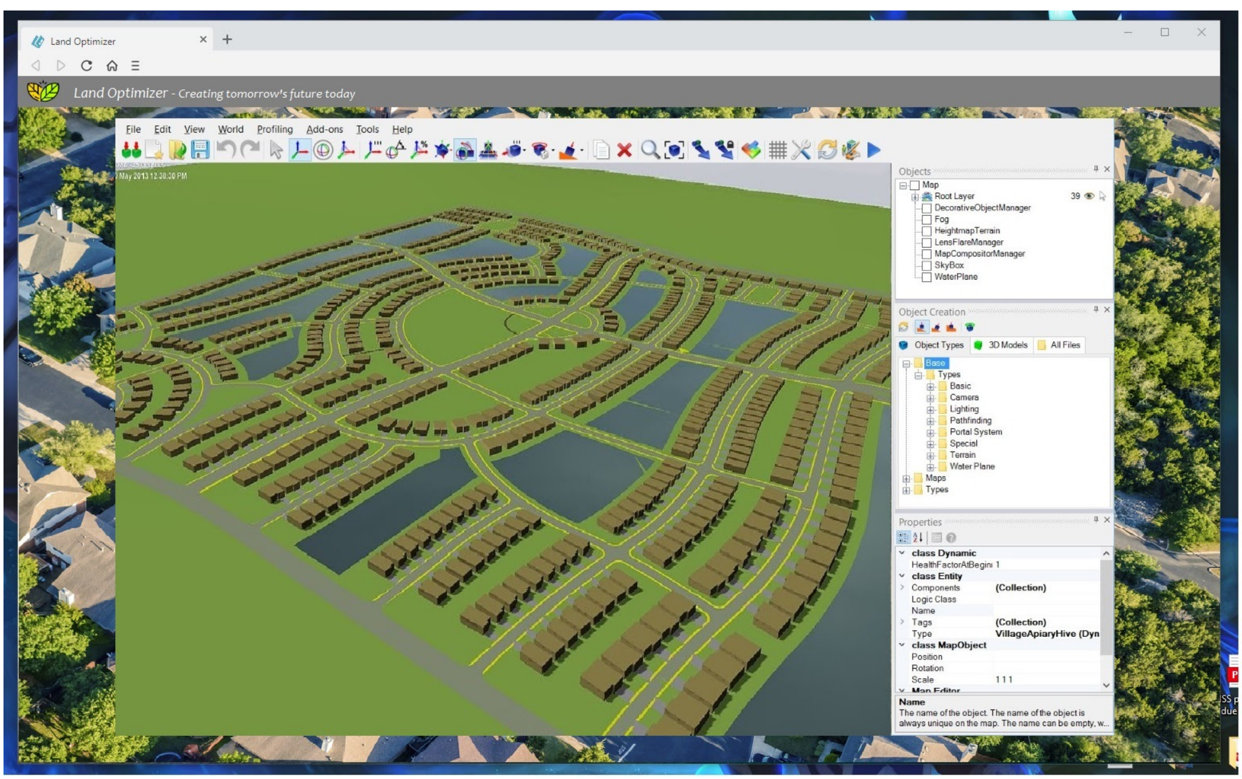


Image 1.2 showing the 2D model of the land schematics.

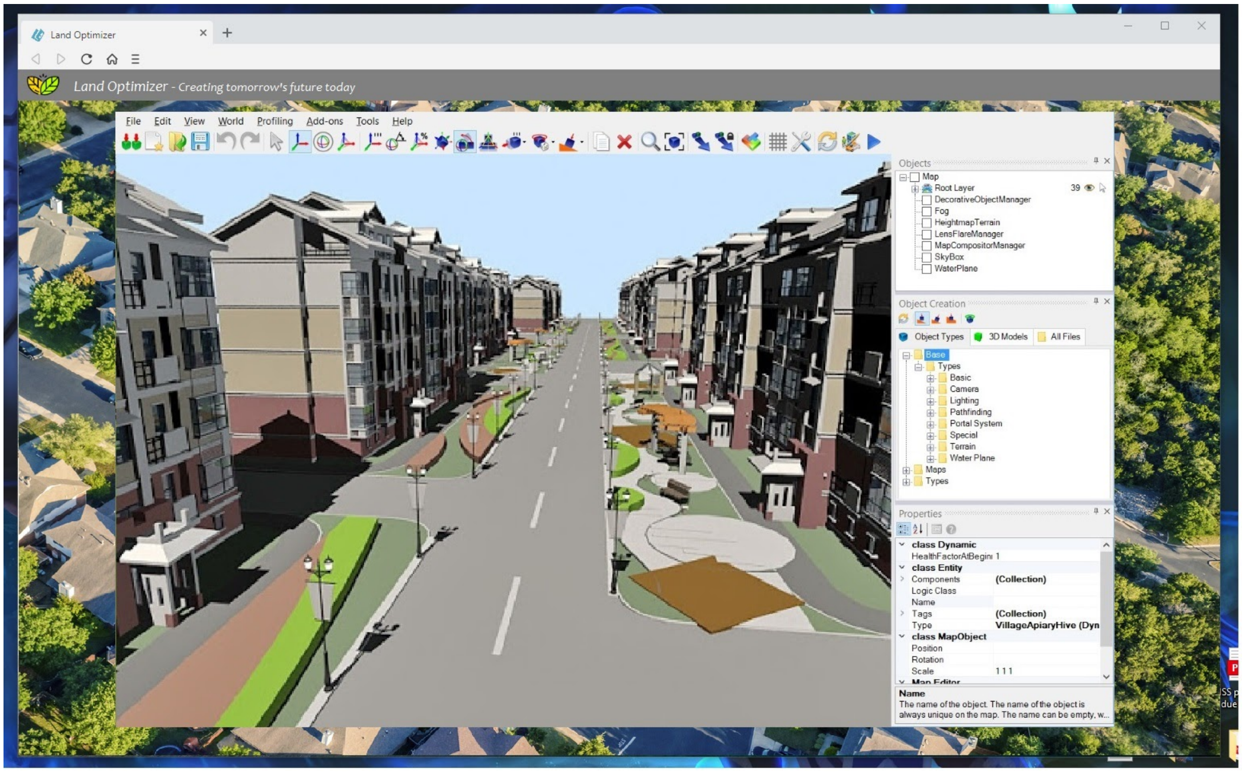


Image 1.2 showing the 3D model of the land schematics.

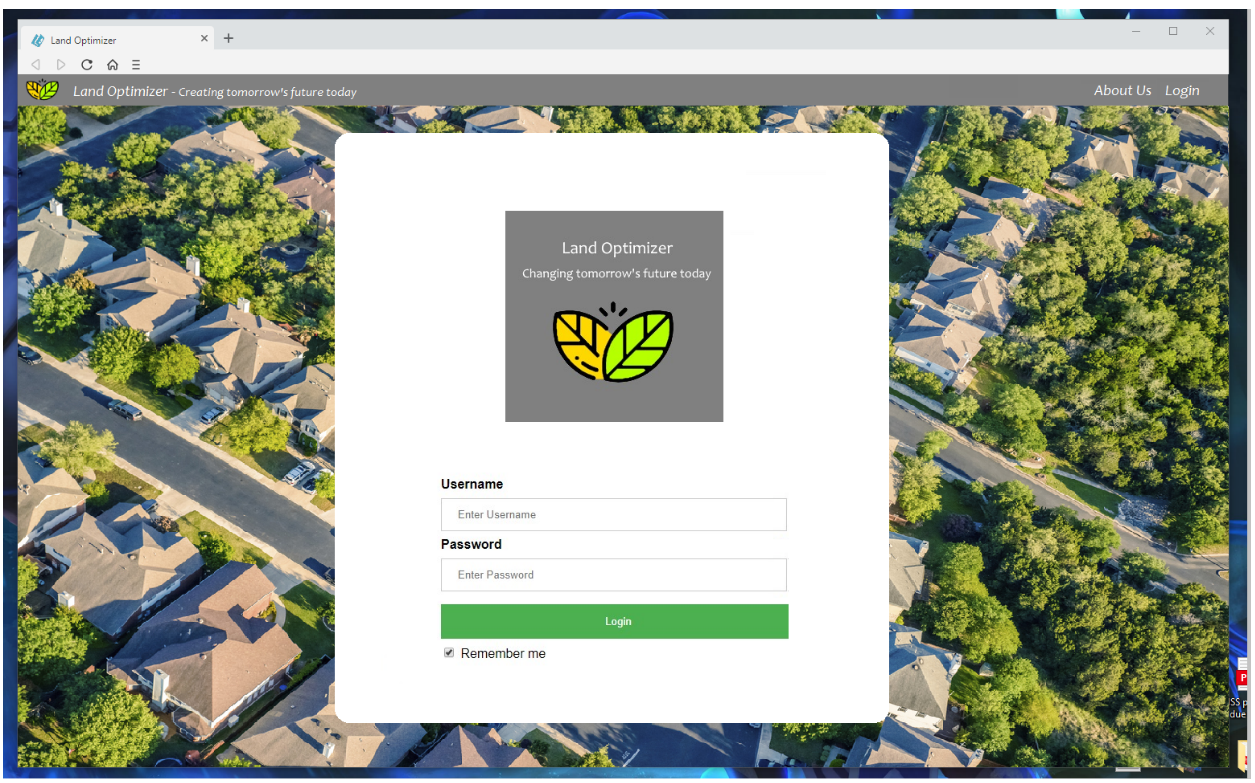


Image 1.3 showing the login page for the user interface.

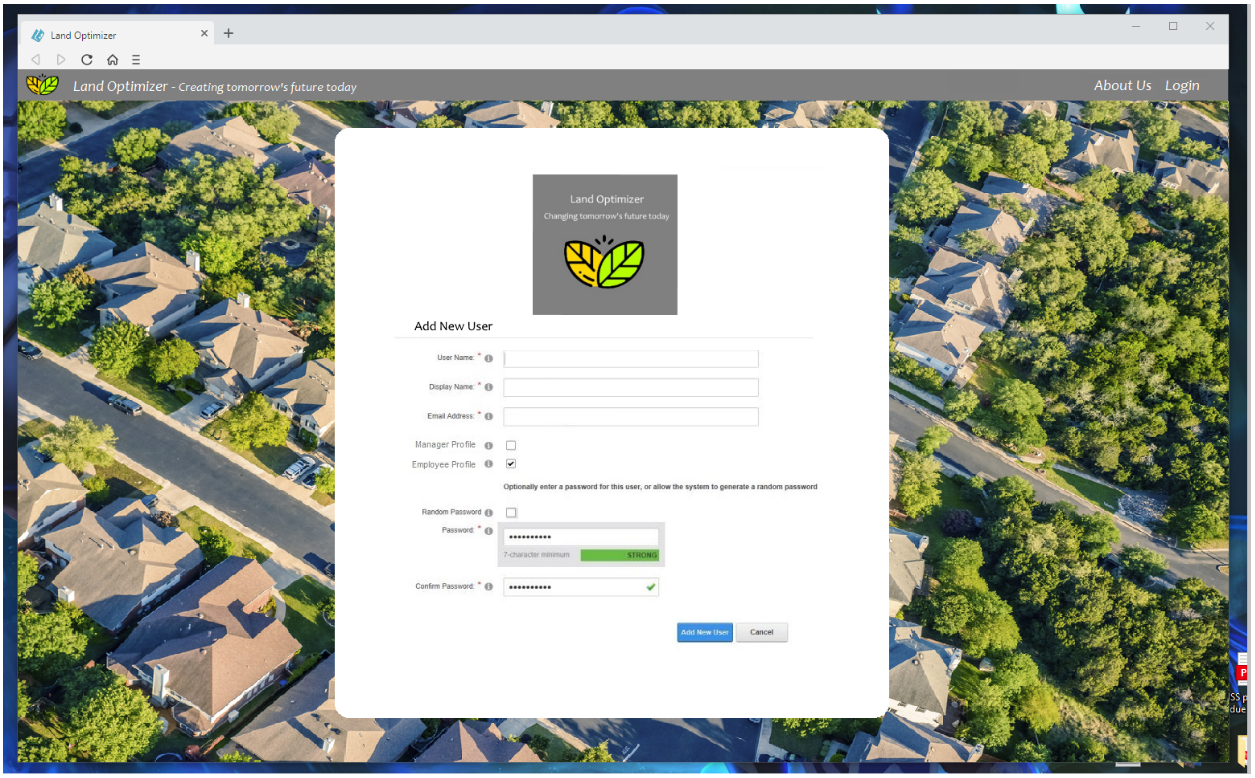


Image 1.4 showing the interface used by the manager to add new managers or add new employee profiles to the software. This essentially gives each employee their own work space.

Glossary

3D graphical model	A three dimensional visual representational display.
agricultural issues	Problems or important topics relating to land cultivation
building codes	Regulations involving the erection of a structure
building schematics	A diagram outlining the dimensions of a structure
centralization	The organization and control of activity around an area. (with respect to city centralization)
climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
databases	A structured set of data held in a computer, especially one that is accessible in various ways
economic	Relating to, or based on the production, distribution, and consumption of goods and services
emerging technologies	New techniques to approaching problems using scientific knowledge
Input and data processing segment	A module implemented to process the data that is uptaken by the User Interface
Internal building size database	A database that stores distinct building sizes of varying stories.
Internal Solutions Report Database	A database where an employee's reports are stored
manager privileges	A unique set of entitlements based on the account type.
module	Each of a set of standardized parts or independent

	units that can be used to construct a more complex structure, such as an item of furniture or a building.
multiple optimized solutions	A distribution of best fit scenarios
non-renewable	Existing in finite quantity; not capable of being replenished.
optimal	Best or most favorable
optimal layout	Best fit arrangement
pollution	The presence in or introduction into the environment of a substance or thing that has harmful or poisonous effects
population capacity	The maximum amount of inhabitants allowed for a specified area
resource	A supply of specific materials
restricted building areas	Designated spaces where construction is not permitted
sandbox	A virtual space which allows testing and creative tools within the limitations of the program
security database	This is an encrypted database which allows for login information to be stored
Security System	This is a module that is runned as part of the software geared at authenticity and authorization of users
sprawl	This refers to the layout or stretch
sustainable	To be maintained
urban	Relating to, or characteristic of a town or city
user privileges	A basic set of entitlements based on the account type
utility infrastructure	Services facilities eg. water ,electricity, roads.

Summary

Land Optimizer software is essentially a multi-tiered application based on building around the environment rather than grading down the land to fit traditional needs. It is specifically geared to Trinidad and Tobago taking into consideration the EMA, Town and Country and the Planning and Development division policies. Land is already a non-renewable resource that is often used without thought of future implications. As a developing country we have identified that traditional developmental approaches taken by countries like the United States and Switzerland are not applicable to small island states. Our land is limited and our population is growing at an exponential rate. An optimal solution must be found for housing.

We, Group 3, propose that the designed application is a move to remedy this ailment. Our land area is already limited. We must make a move to use it as efficiently as possible while keeping in mind the sensitivity and biodiversity of the area we occupy. By optimizing the use of land in urban areas we are better able to conserve our tropical rainforest. This software is capable of restricting building to an area, leaving a sufficient buffer zone and optimizing the space that remains to fit the population that you desire. It has a simple design that is elegant and easy to use. There is even space to let your creativity take shape . It is capable of giving multiple solutions and ensures that the user is aware of the reports necessary to accomplish your goals. Using this software not only means building the best solution for today, but for the future.

In this project we outlined the cost of that future to be about six million dollars which is a small price to pay to ensure you are always making the best building decisions.

Conclusively, any investment into an optimizing software is an investment into an inevitable future. This project has put in the research and the groundwork for a successful application.

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