

ISOFT TECHNOLOGIES

# Software Design Document

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## Sub Surface Soil Profiling System V3

Version 0.4.0

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*A Software Design Document by iSoft Technologies for Sub Surface Soil Profiling System V3. iSoft Technologies is a group of four students commencing their Final Year Project A. This document can be used to improve the K.R InfoSys Sub Surface Soil Profiling System.*

## Version

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## **1.0 Introduction**

### **1.1 Purpose**

The purpose of this Software Design Document is to depict the details of Sub Surface Soil Profiling System V3 and the changes that have been made. In general, system design describes the definition of the system from developers' point of view. During this phase, developers define the architecture of the system in terms of design goals and subsystem decomposition. Certain aspects are addressed which includes mapping of the system on hardware, storage of persistent data and global control flow. It emphasizes the use of design patterns, components and UML to deal with solution domain complexity.

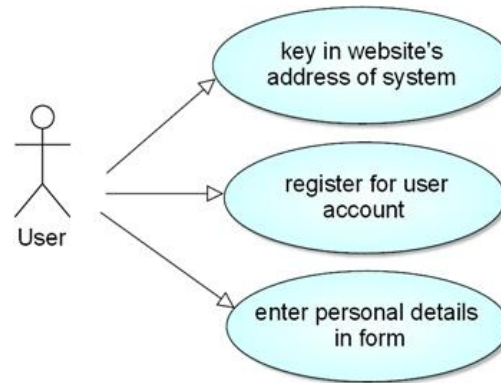
### **1.2 Scope**

This document focuses on the design principles that would be adhered to while programming and articulating the software. It includes things that will be changed or modified on the system and in some sections of the document, the interaction between new and old components are highlighted. In the process of designing the software, team has documented UML Class Diagram, Sequence Diagram, Data Flow Diagram and ER Diagram.

## 2.0 Use Case Diagrams

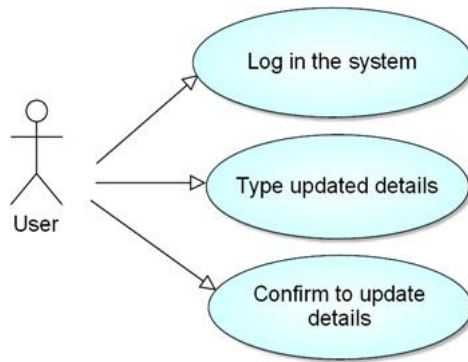
Use case scenarios describe real time system interaction according to the user's perspectives. All use cases focus on the main functionality of the system.

### 2.1 Access the system



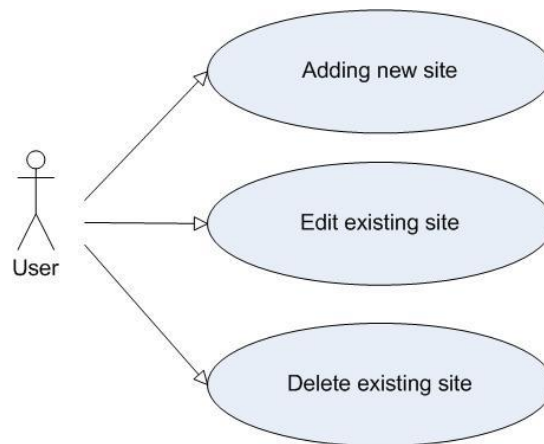
<b>Task</b>	User log in the system.
<b>Purpose</b>	Enables a user to access the system.
<b>Trigger</b>	User has registered and wants to get access of the system
<b>Frequency</b>	Every time user wants to login
<b>Sub Task</b>	
1. User loads the website	<ul style="list-style-type: none"><li>User opens a browser and types the address of the website where Sub Surface Soil Profiling System V3 is hosted.</li></ul>
2. User enters authentication details to access the system	<ul style="list-style-type: none"><li>User inputs username and password into relevant fields</li></ul>
3. User is granted the permission to use the software	<ul style="list-style-type: none"><li>The permission to use the system has been granted.</li><li>Home page of system is displayed.</li></ul>

## 2.2 Manage user account



<b>Task</b>	User access the system.
<b>Purpose</b>	Enable user to update selected details in user profile.
<b>Trigger</b>	User is registered and logged in the system.
<b>Frequency</b>	Every time user is logged in the system.
<b>Subtask</b> 1. User begins and end the session from the system.	<ul style="list-style-type: none"><li>• User type in the address of Soil Profiling system, enter username and password.</li><li>• User logout the system to end the session.</li></ul>
2. User changes the personal details from user profile.	<ul style="list-style-type: none"><li>• User click username link and “My User Profile” page are displayed.</li><li>• User type in the required changes in their account.</li></ul>

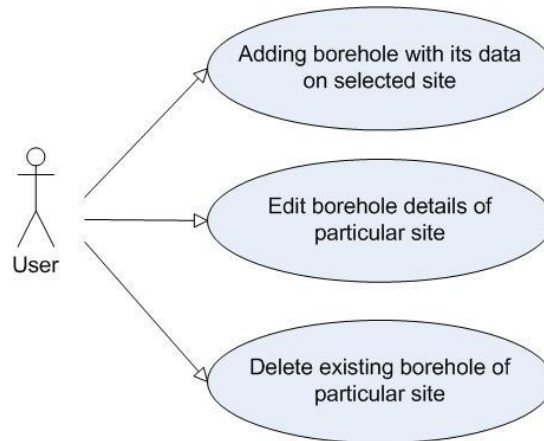
## 2.3 Manage site data



<b>Task</b>	User manages site data.
<b>Purpose</b>	Enables user to add new details, edit site's details and delete site data.
<b>Trigger</b>	User is logged in the system. User updates site data.
<b>Frequency</b>	Every time user is login in the system.
<b>Subtask</b> <ol style="list-style-type: none"><li>1. User key in related information of site to add new site.</li><li>2. User edits details of sites to be updated.</li><li>3. User removes</li></ol>	

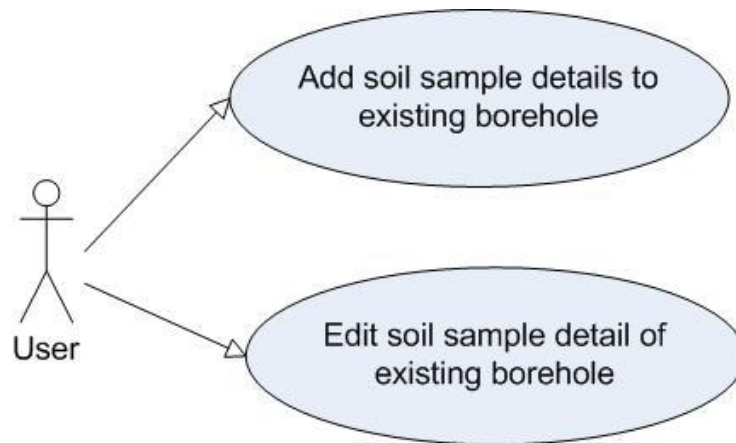


## 2.4 Manage borehole data



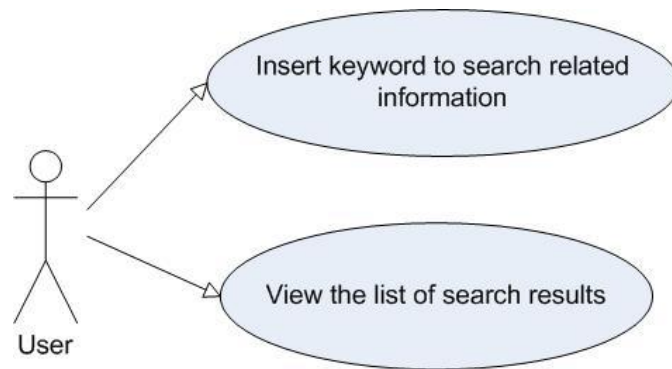
<b>Task</b>	User wants to add and edit the information of borehole data in the system.
<b>Purpose</b>	Enables user to update boreholes data.
<b>Trigger</b>	User is logged in the system
<b>Frequency</b>	Every time user is login the system.
<b>Subtask</b> <ol style="list-style-type: none"><li>1. User adds new data of boreholes from spreadsheet file.</li><li>2. User is provided list of borehole from sit and view the list to proceed add, edit or delete.</li><li>3. User makes confirmation or reset of the related information when adding and edit of borehole.</li></ol>	

## 2.5 Manage soil sample



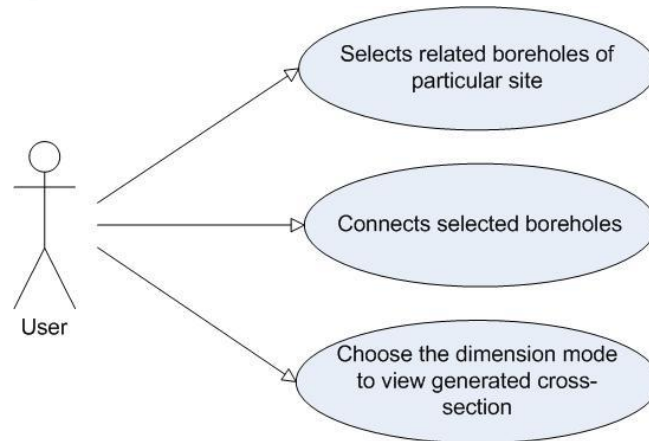
<b>Task</b>	User wants to include soil sample information of borehole.
<b>Purpose</b>	Enable user to have the details of soil samples for particular borehole.
<b>Trigger</b>	User is logged in the system
<b>Frequency</b>	Every time user is login the system.
<b>Subtask</b> 1. User add new information of soil sample from spreadsheet file. 2. User selects related details of soil to edit.	

## 2.6 Search site



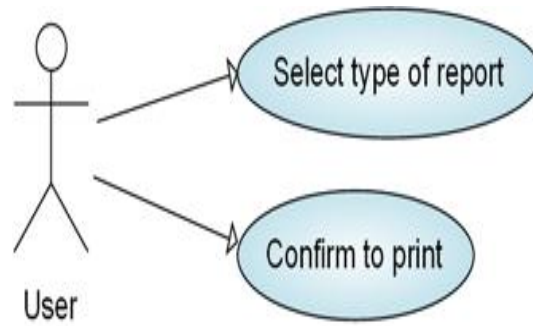
<b>Task</b>	User wants to search related information of soil/borehole according to site.
<b>Purpose</b>	Enable user to search site that contains borehole information and soil sample data information.
<b>Trigger</b>	User is logged in the system.
<b>Frequency</b>	Every time user is login in the system.
<b>Subtask</b>  1. User type in a keyword of site. 2. User able to browse and select from list of results.	

## 2.7 Generate soil profile



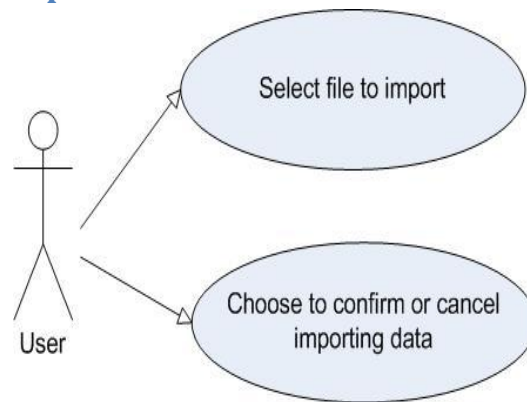
<b>Task</b>	User wants to view the profile of soil from particular site.
<b>Purpose</b>	Enables user to view the soil profile.
<b>Trigger</b>	User is logged in the system.
<b>Frequency</b>	Every time user is login the system.
<b>Subtask</b> 1. User selects the desired site. 2. User selects borehole points to be generated.	

## 2.8 Generate report



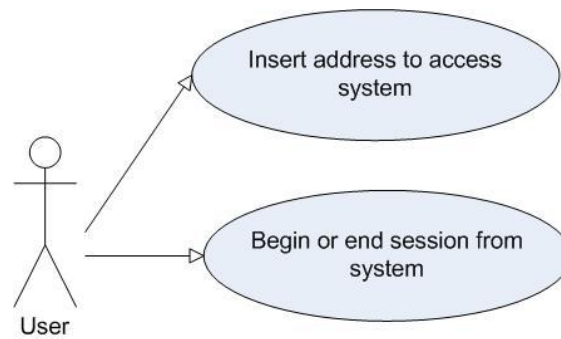
<b>Task</b>	User acquires a report of site.
<b>Purpose</b>	To produce reports of particular site with its related information.
<b>Trigger</b>	User is logged in the system.
<b>Frequency</b>	Every time user is logged in the system. User confirmation of requiring the report.
<b>Subtask</b> 1. User selects the type of report to be generated; site report, borehole report or lab test result. 2. User view generated report to confirm the borehole report.	

## 2.9 Import data from spreadsheet



<b>Task</b>	User manages the details of site that contains boreholes data and soil samples data
<b>Purpose</b>	Enable user to import data from spreadsheet file to the system.
<b>Trigger</b>	User is logged in the system.
<b>Frequency</b>	Every time user is login the system.
<b>Subtask</b>	<ol style="list-style-type: none"><li>1. User selects files from external source to be uploaded.</li><li>2. User confirms to upload the data.</li></ol>

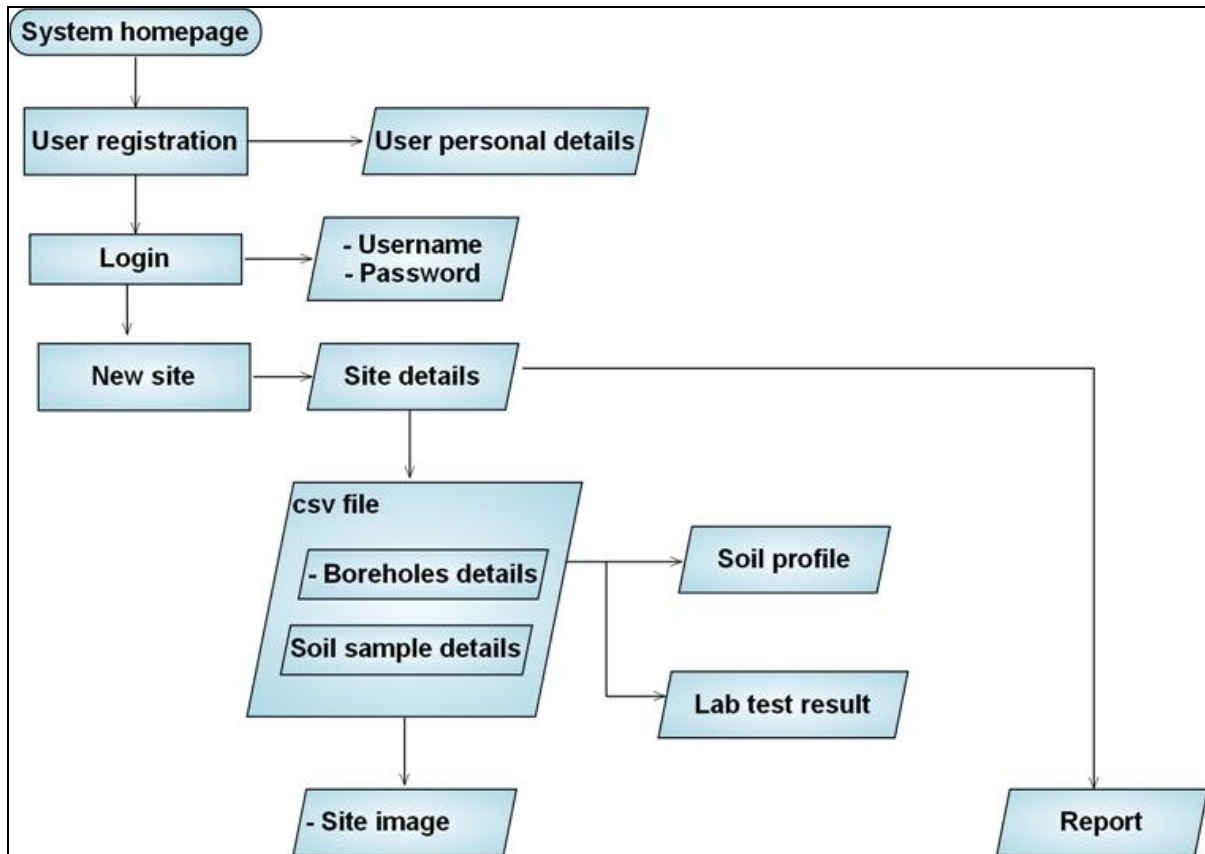
## 2.10 Access system from mobile devices



<b>Task</b>	User wants to access the system from mobile devices
<b>Purpose</b>	Enable user to access the system from mobile devices.
<b>Trigger</b>	User device's has the supported content to access the system homepage.
<b>Frequency</b>	Every time user access from mobile devices.
<b>Subtask</b>	<ol style="list-style-type: none"><li>1. User key in the address of the homepage.</li><li>2. User key in username and password to login.</li><li>3. User begins and end the session from the system.</li></ol>

### 3.0 Data Flow Diagram

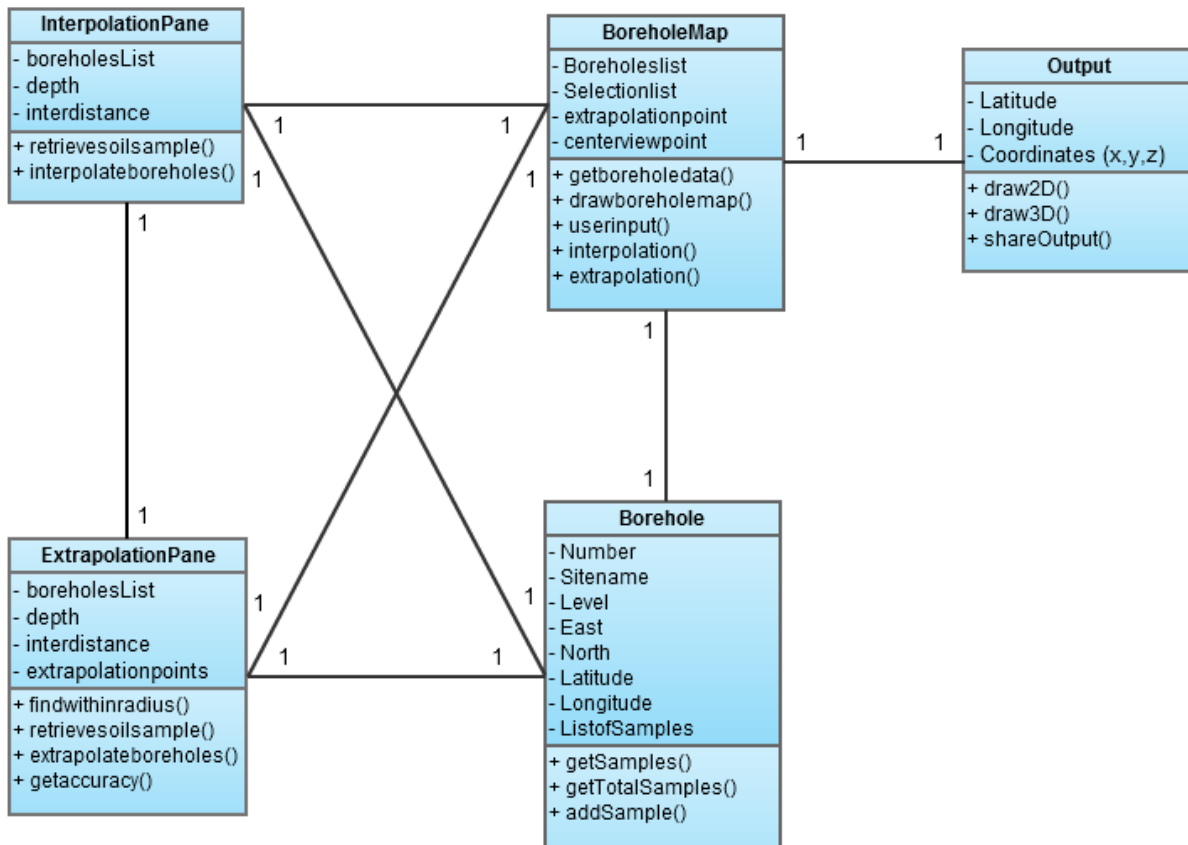
The Data Flow Diagram for Sub Surface Soil Profiling System V3 is shown as below:





## 4.0 UML Class Diagram

The UML Class Diagram of Sub Surface Soil Profiling System V3 is shown as below:

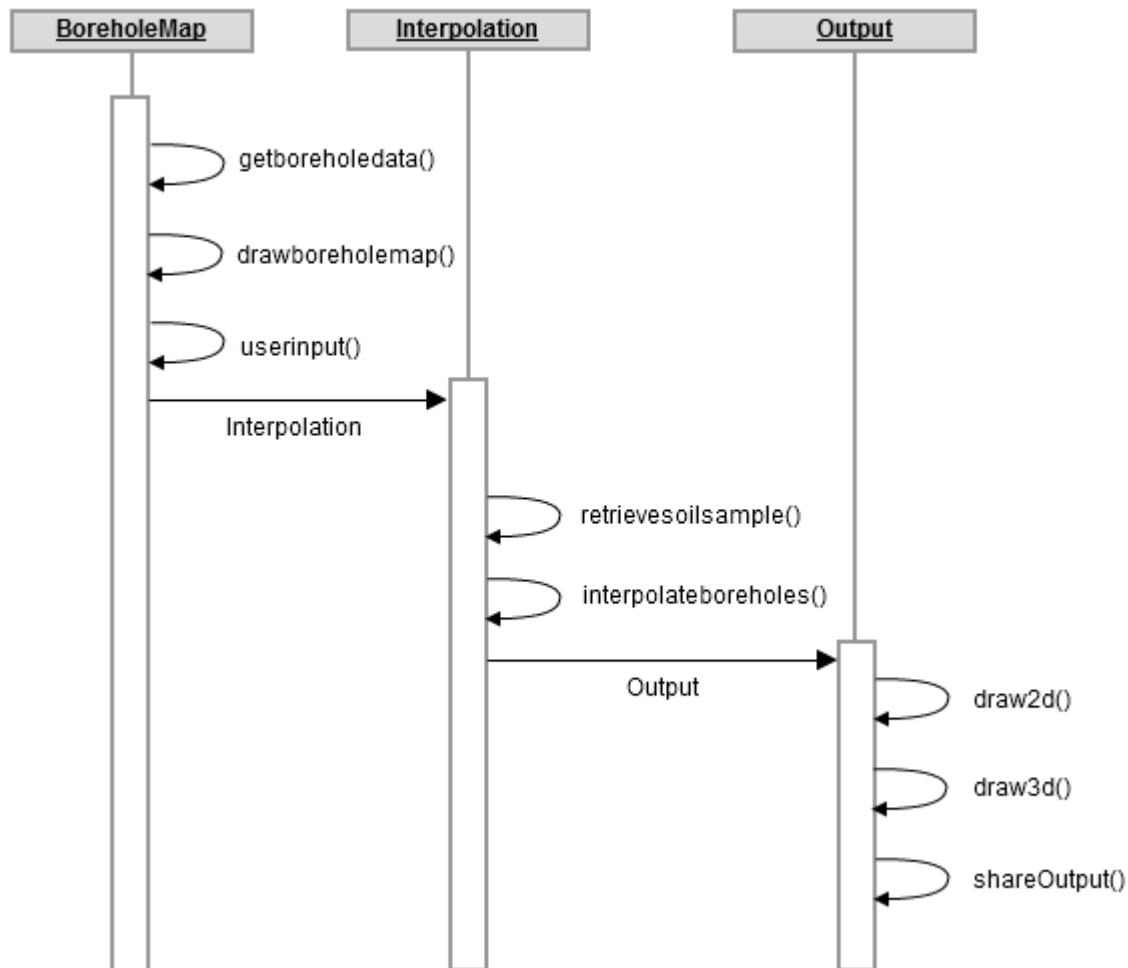


Team has decided to retain those 5 main classes from the previous version of the software as changes only happen to the class internal structure. At the moment, only one change is made to Output class. A new function, shareOutput() is introduced to allow user to share their outputs with other users.

## 5.0 Sequence Diagram

### Interpolation

Below is the sequence diagram for interpolation and output:

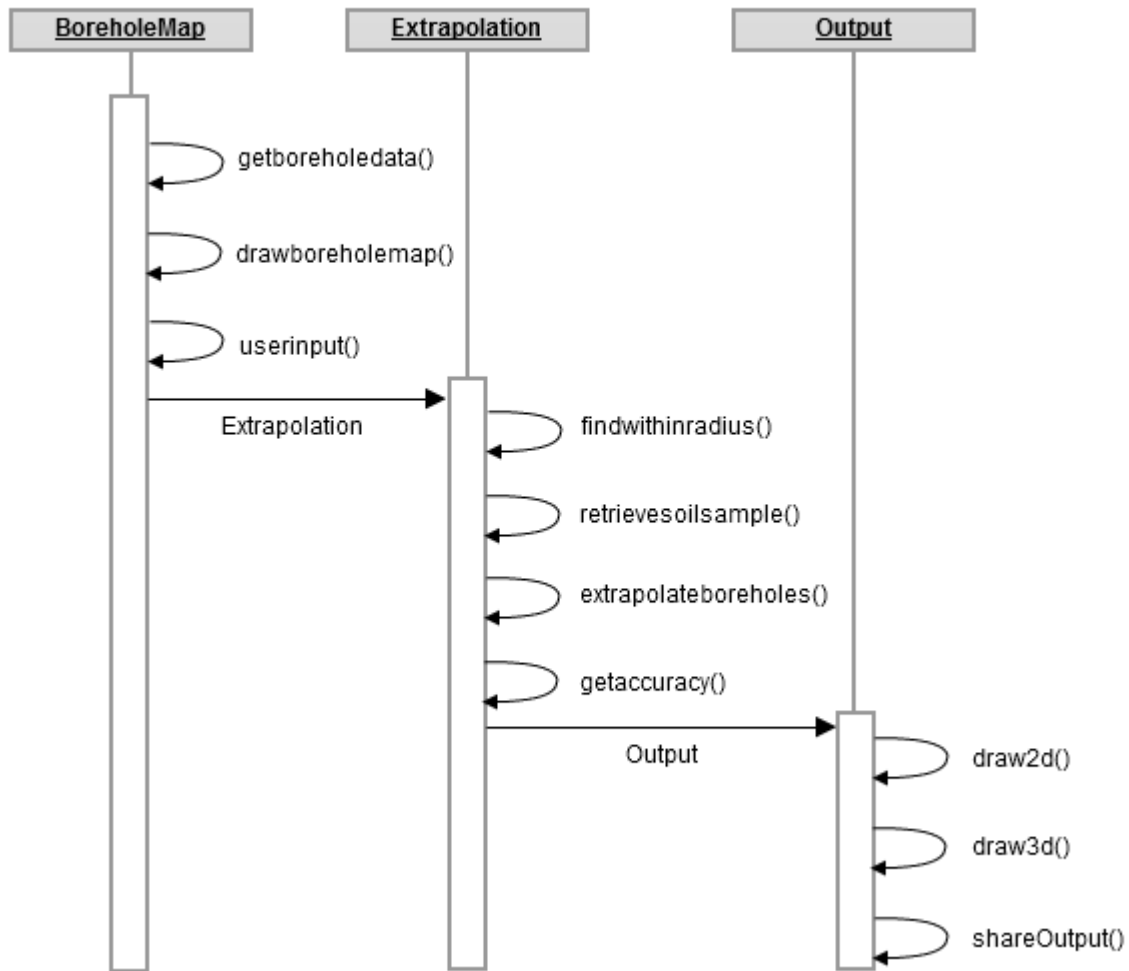


The output module is introduced by KR InfoSys during the previous version in order to give the user a choice to select the view perspectives, the 2D output.

For the latest version of Sub Surface Soil Profiling System, team will adjusting the legend box into same 2D output window that was initially was separated.

### Extrapolation

The figure below shows the sequence diagram of the extrapolation and output with an accuracy level method included as a core functional enhancement. Other functions were retained from the existing system and interactions will be similar in the new coding.



Similar to the interpolation, the output module is introduced by KR InfoSys in the previous version to give the user a choice to select perspectives which include:

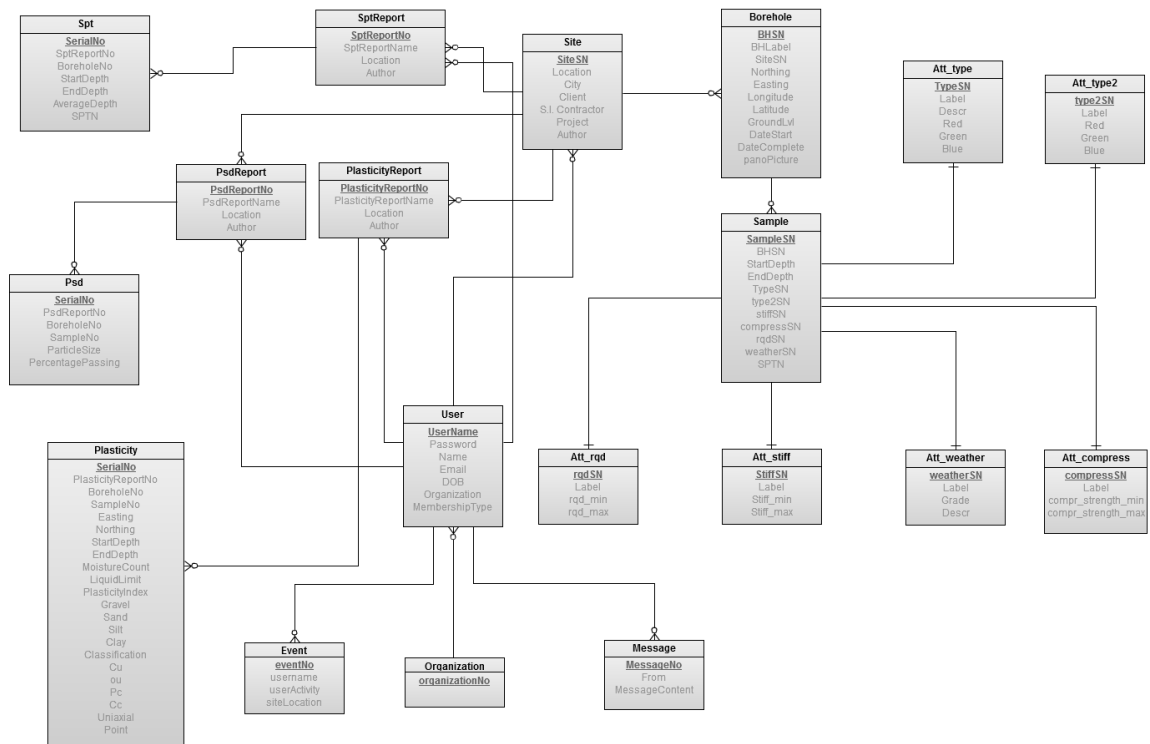
- 2D output
- 3D output

[\*\*\*some description is removed]

## 6.0 Extended Entity Relationship Diagram

The diagram below shows the Extended Entity Relationship Diagram for the data that is going to be stored in the system's database

Entity Relationship Diagram (ERD)



## 6.1 USER Table

Primary Key	UserName (varchar)
Foreign Key	None
Other Attributes	Password (varchar)
	Name (varchar)
	Email (varchar)
	DOB (date)
	Role (int)
	Organization (varchar)

The USER table contains details of the users including authentication details

## 6.2 SITE Table

Primary Key	SiteSN (int)
Foreign Key	Author (varchar) – referenced to UserName from USER table
Other Attributes	Location (varchar)
	City (varchar)
	Client (varchar)
	<b>S.I. Contractor (varchar)</b> – <i>New attribute</i>
	Project (varchar)

The SITE table will hold all information about a construction site. This site might contain borehole(s) which will then be used to search, modify or delete borehole data. Also the data structure is defined as such, so that any new information can be easily stored and updated without any extra unnecessary efforts. New attribute added in this table for the latest version of Sub Surface Soil Profiling System is S.I. Contractor.

## 6.3 BOREHOLE Table

Primary Key	BhSN (int)
Foreign Key	siteSN (int) – referenced to SiteSN from SITE table
Other Attributes	Label (varchar)
	GroundLvl (decimal)
	Easting (decimal)
	Northing (decimal)
	Longitude (double)
	Latitude (double)
	DateStart (date)
	DateComplete (date)
	<b>panoPicture (varchar)</b> – <i>New attribute</i>

The BOREHOLE table will hold all information about one borehole, which would be used to search, modify or delete borehole data.

## 6.4 SOILSAMPLE Table

Primary Key	SampleSN (int)
Foreign Key	BhSN (int) – referenced to BoreholeSN from BOREHOLE table TypeSN (int) – referenced to TypeSN from ATT_TYPE table type2SN (int) – referenced to type2SN from ATT_TYPE2 table stiffSN (int) – referenced to StiffSN from ATT_STIFF table compressSN (int) – referenced to compressSN from ATT_COMPRESS table rqdSN (int) – referenced to rqdSN from ATT_RQD table weatherSN (int) – referenced to weatherSN from ATT_WEATHER table
Other Attributes	StartDepth (decimal)
	EndDepth (decimal)
	SPTN (int)

The SOILSAMPLE table will hold all information about soil sample inside a borehole, which would be used to search, modify or delete borehole data. The SOILSAMPLE would also hold the necessary information to produce a graph as requested by the user. The data structure is defined as such, so that any new information can be easily stored and updated without any extra unnecessary effort

## 6.5 ATT\_COMPRESS Table

Primary Key	compressSN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	compr_strength_min (float)
	compr_strength_max (float)

This table contains the compress details. The “compressSN” is the serial number for each of the different compress value. “Label” means the value or description for compress. “compr\_strength\_min” and “compr\_strength\_max” define the range of compress for each value (“Label”).

## 6.6 ATT\_RQD Table

Primary Key	rqdSN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	rqd_min (float)
	rqd_max (float)

“rqdSN” means the RQD serial number. “Label” means the value or description for each RQD. “rqd\_min” and “rqd\_max” define the range of RQD for each value (“Label”).

## 6.7 ATT\_STIFF Table

Primary Key	StiffSN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	SPTN_min (float)
	SPTN_max (float)

This table contains the stiffness details. The “stiffSN” is the serial number for the each of the different stiffness value. “Label” means the value or description for stiffness. “SPTN\_min” and “SPTN\_max” define the range of stiffness for each value (“Label”).

## 6.8 ATT\_TYPE Table

Primary Key	TypeSN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	Descr (varchar)
	Red (int)
	Green (int)
	Blue (int)

This table contains the soil type details. The “TypeSN” is the serial number for the each of the different soil. “Label” means the value or name for each soil type. “Descr” is an attribute that contains extra information and description of that particular soil type. “Red”, “Green” and “Blue” contain numbers which form RGB color model. The combination of these three attributes represents the soil type color.

## 6.9 ATT\_TYPE2 Table

Primary Key	type2SN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	Red (int)
	Green (int)
	Blue (int)

This table attributes almost the same as ATT\_TYPE Table. The difference is the “Label” value.

### 6.10 ATT\_WEATHER Table

Primary Key	weatherSN (int)
Foreign Key	None
Other Attributes	Label (varchar)
	Grade (varchar)
	Descr (varchar)

This table contains the weather detail for a soil sample. The “weatherSN” is the serial number for each of the different weather. “Label” refers to the value or name for each weather. “Grade” is the attribute that that define the grading for weather according to the civil engineering standard. “Descr” is contains extra information and description of that particular weather.

### 6.11 MESSAGE Table (NEW)

Primary Key	MessageNo (int)
Foreign Key	None
Other Attributes	From (varchar)
	MessageContent (varchar)

### 6.12 EVENT Table (NEW)

Primary Key	eventNo (int)
Foreign Key	None
Other Attributes	username (varchar)
	userActivity (varchar)
	siteLocation (varchar)
	Time (datetime)

### 6.13 ORGANIZATION Table (NEW)

Primary Key	organizationNo (int)
Foreign Key	None
Other Attributes	Organization Name (varchar)
	MessageContent (varchar)



#### 6.14 PLASTICITYREPORT Table (NEW)

Primary Key	PlasticityReportNo (int)
Foreign Key	None
Other Attributes	PlasticityReportName (varchar)
	Location (varchar)
	Author (varchar)

#### 6.15 PLASTICITY Table (NEW)

Primary Key	SerialNo (int)
Foreign Key	None
Other Attributes	PlasticityReportNo (int)
	BoreholeNo (varchar)
	SampleNo (varchar)
	Easting (decimal)
	Northing (decimal)
	StartDepth (decimal)
	EndDepth (decimal)
	MoistureCount (decimal)
	LiquidLimit (decimal)
	PlasticityIndex (decimal)
	Gravel (decimal)
	Sand (decimal)
	Silt (decimal)
	Clay (decimal)
	Classification (varchar)
	Cu (decimal)
	ou (decimal)
	Pc (decimal)
	Cc (decimal)
	Uniaxial (decimal)
	Point (decimal)

#### 6.16 PSDREPORT Table (NEW)

Primary Key	PsdReportNo (int)
Foreign Key	None
Other Attributes	PsdReportName (varchar)
	Location (varchar)
	Author (varchar)

### 6.17 PSD Table (NEW)

Primary Key	SerialNo (int)
Foreign Key	None
Other Attributes	PsdReportNo (int)
	BoreholeNo (varchar)
	SampleNo (varchar)
	ParticleSize (decimal)
	PercentagePassing (decimal)

### 6.18 SPTREPORT Table (NEW)

Primary Key	SptReportNo (int)
Foreign Key	None
Other Attributes	SptReportName (varchar)
	Location (varchar)
	Author (varchar)

### 6.19 SPT Table (NEW)

Primary Key	SerialNo (int)
Foreign Key	None
Other Attributes	SptReportNo (int)
	BoreholeNo (varchar)
	StartDepth (decimal)
	EndDepth (decimal)
	AverageDepth (decimal)
	SPTN (int)

## 7.0 References

- Evans, Isabel (2004) Achieving Software Quality through Teamwork (2004), Artech House Inc.
- (GO-ITS), G. o. O. I. S. (2007), Information and Technology Standards, Ontario, Government of Ontario: 10-12
- Young, Y.K.C. a. K. Y. “Analysis of piles subjected to lateral soil movements” The Institution of Engineers, Singapore **36**(2): 43-44