

Final Year Project Report
Soil Conditions Logging System

SINGAPORE POLYTECHNIC
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

PROJECT NO:

EEE-16A134

SOIL CONDITION LOGGING SYSTEM

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Acknowledgements:

Our group would like to thank Land Transport Authority (LTA) for the opportunity to work with them on this project. It was an interesting learning experience for us to delve into the world of iOS Swift and other different contexts that we have never learnt before in our School. Overall, we would like to extend our gratitude to Singapore Polytechnic for providing us with this opportunity to put our skills and capabilities to good use.

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ABSTRACT

Purpose: The purpose of this project is to design and implement a real time monitoring system that speeds up the process of geotechnical investigation.

Project Description: This monitoring system allows geologists on site to key in data of geotechnical investigation through the android application or the website. Personnel in charge from LTA will be able to access and edit the data entered by the geologists through the website. The system also converts data into a Log borehole which is a thorough report of the geotechnical investigation.

Conclusion: The system design has met the satisfactory requirement of LTA and is almost ready for deployment to improve geotechnical investigation in the industry.

Recommendations: The system could be more client friendly by adding more flexibility in the data entry.

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PROJECT TIMELINE

2016	Server Progress	iOS Progress
April	Planning of project. Made sure to meet requirements every week, Maintain discipline within our group	Planning of project. Made sure to meet requirements every week, Maintain discipline within our group
May	Planning of roles and technical details of the project. Learning of technical skills needed for the project i.e., PHP, JSON, MySQL,	Planning of roles and technical details of the project. Learning of technical skills needed for the project i.e swift
June	Designing of User Interface. UI was designed to be uniform across IOS app and the Server.	Designing of User Interface. UI was designed to be uniform across IOS app and the Server.
July	User Interface implementation Switching from SQLite to MySQL	User Interface implementation First IOS app prototype created.
August	User Interface implementation	Designing and implementation of local databases for IOS app.
September	User Interface implementation Uses XAMP Server for setup	Implementation of local databases IOS app. Implementation of user authentication function.
October	Database Designing Implementation of synchronising algorithms	Planning and implementation of synchronization with server
November	Change to MAMP server Database re-implementation PHP designing	Re-design of IOS app. Implementation of synchronization with server

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	Planning and Implementation of Synchronising Algorithm	
December	Database Relationship Planning PHP Implementation	Implementation of synchronization with server functions.

2017

January	Getting Server system ready for group and individual presentation	Fix bugs and make minor changes
February	Report submission Project ends	Report submission Project ends

Chapter 1

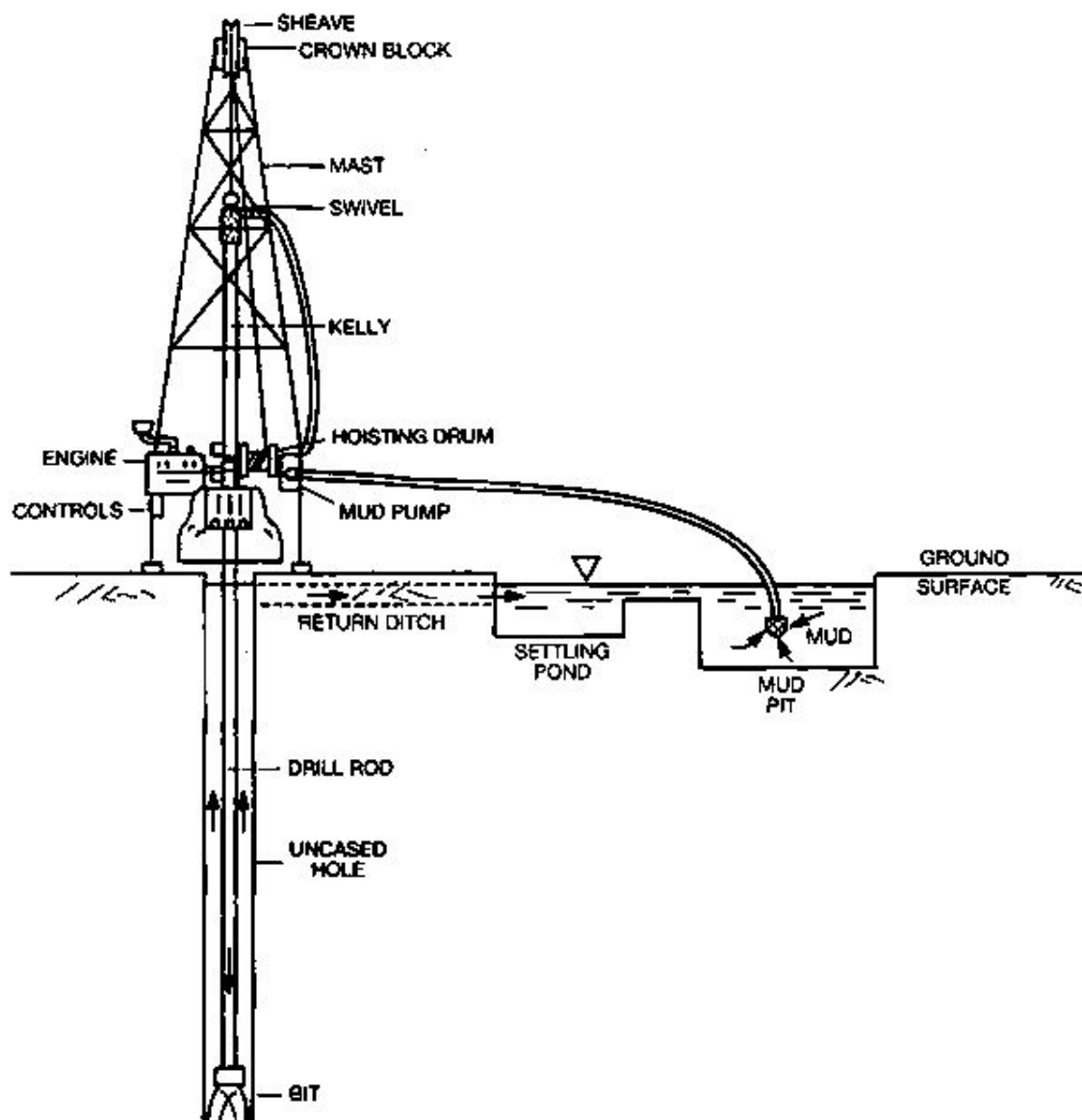
Introduction

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Concept Overview

The Soil Conditions Logging System is a real time monitoring server client database that is designed to improve the workflow of both contractors and clients for geotechnical investigation.



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During a Geotechnical Investigation, a project will be outsourced to a Contractor for investigation works. Assigned under this project, are numerous boreholes; which will be dug around a certain proximity to obtain underground soil and rock properties. At each borehole, soil observations are carried out at certain depths. These observations will vary based on the tests conducted. For example, in the first 3 meters of soil, a Trial Pit and Hand Auger is performed, observed, and recorded down. In the next 2 meters, either a Sampling or an In-Situ Test is taken.

When a borehole log is completed, it is converted into a report. This is used as a reference by contractors or geologists for understanding soil conditions or determining construction methods in an area.

The Soil Conditions Logging System incorporates the use of a server and client database to automate this entire logging process. It is also able to generate the final report as a pdf document to meet project requirements. The system also fulfils the requirements of a Real Time Monitoring System that tracks and monitors the real time progress of the soil condition logging process; through near instantaneous data synchronizing with a centralized server.

Project Client

The Original Soil Conditions Logging System project was issued by the Land Transport Authority (LTA) in 2015. LTA is a statutory board under the Ministry of Transport and is responsible for planning, operating and maintaining Singapore's land transport infrastructure and system.



This Borehole Logging Application that we created will be utilized by the Geotechnical and Tunnels division of LTA. Contractors attached under this division

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will use the system to record down details from geotechnical investigations. They would be able to immediately record down details using a phone application instead of using pen and paper.

This project is a continual project and an improvement project from the previous year. We have chosen to create and innovate an apple version of this application. This will allow iPhone users to be able to store data in the database too. This will cater to more employees working on on-site work where they do not need to record their findings on paper and pen.

This system utilizes mobile devices and computers. An administrator is required to manage database and data at the server end. Users are expected to have knowledge regarding Geotechnical Investigation before using this system. This is due to the standards and units that are required to be entered. Users will access the system through desktop browsers, through the android app, using android devices or iOS devices, as long as their devices are connected to the internet. Both platforms feature simple user interface for clarity and intuitive usage. The only requirement is the installation of the application.

Chapter II

Value

Proposition

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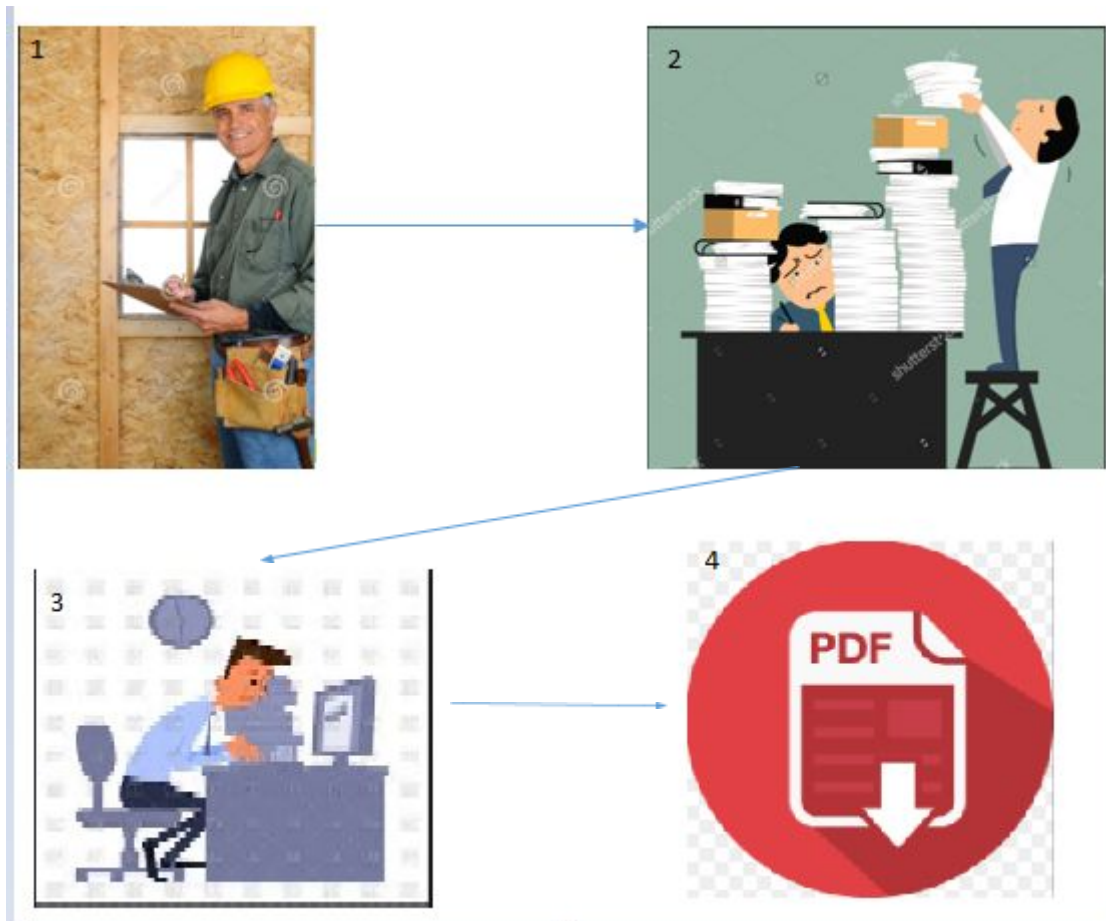
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Current Situation

As of now, the entire geotechnical investigation logging process is done manually using written forms and paperwork. This process can take up to a month due to the sending and verification of data, which is a painstakingly long process. Additionally, should there be any or errors in data recording, staff would have to search through numerous papers to verify and correct those mistakes. The illustration below demonstrates how the current process is like.

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1. The on-site employee records data onto a piece of paper and place the file into the pdf

In the future, we will have an easier situation where users and administrators will have an easier time compiling data, troubleshooting and management of resources. The illustration shown below demonstrates how the future process is like.

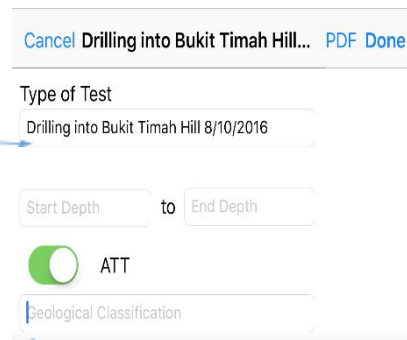
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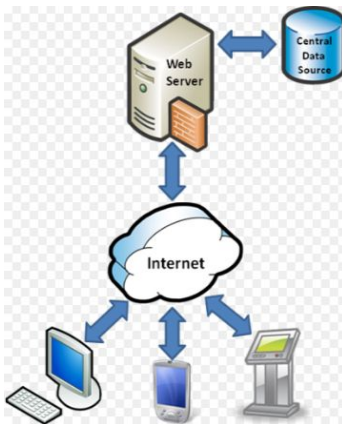
(Figure 2.1)

Portraying someone
Using a phone



(Figure 2.2)

Keying input into phone application



(Figure 2.3)

Data is stored in the
database



(Figure 2.4)

PDF is then generated from
the server

REFER TO PREVIOUS PAGE

In 2.1, at the geological site, a worker brings out his/her phone to record the characteristics down. At 2.2, the characteristics are then keyed into the phone application and are saved locally on the phone. Once the phone is connected to an internet or cellular data, the data stored in the phone will be send over to the database to be stored, just like in 2.3. Afterwards in 2.4, the PDF is generated from the server.

Chapter III

System Description

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Soil Conditions Logging System

The Soil Conditions Logging System is a system made up of a client and server database that saves time and cost while providing an important monitoring system that keeps track of current progress. Improving work flow thus increasing overall productivity exponentially as compared to the current situation which is manual pen and paper work. From the beginning of this industry, the conventional pen and paper method is the current method used to input records. This process takes approximately 2-3 weeks. But now, modern technology can ease the operation to provide an efficient and dynamic workflow by reducing the process to approximately 1 week. With a click of a button, data would be transmitted between the work site and the office immediately. Our Soil Logging System is also low cost, requiring just a server, data / internet, and a mobile phone/personal desktop to access which proves to be able exponentially improve the LTA's operations in soil logging.

Technical Description

The entire soil condition logging system comprises of an android application, a website and the server. The android application is targeted at workers onsite and the website is targeted at the people in the HQ.

Server

The server is running CentOS 9.2. It functions as both a HTTP server and a Database server. Therefore, the IP used in the PHP to connect to the database is 'localhost'. We are currently temporarily hosting the server using **MAMP**, a company that leases its data centres for a fee.

Database

This system database is using MAMP. It works the same way as XAMPP or WAMP,

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only difference is it has more compatibility with MAC OS.

MAMP contains 2 major databases, which are users and entries.

Within these 2 databases, “users” contains login information such as an individual’s username and password. The username and password fields allows staff to register, and login. During registration, an administrator has to manually add in the username and password into the database. For security purposes, we did not add the registration function into the phone application as any user can download the app from the app store and register an account to access LTA secured information.

For the login, we have to post the inputs from the text fields to the database, allowing the database to authenticate from the selected table to allow users to login into the database with a secured connection.

Entries contains information such as “TrialPit, Sampling, Borehole and GroundWater”. We have created the application in the way where the user is able to synchronise data from the server. They can pre-download the data into the application so that if the user entered a NO-WIFI zone, they are able to view the data offline. The input fields are self-explanatory as they are labelled according to their respective standards.

Software Used

MAMP – Open Source and proprietary commercial software

Xcode Version 7.8 (Swift 2.2 Programming software)

Netbeans IDE (For programming PHP code on windows PC)

Notepad ++ (For modifying PHP codes on the macbook)

TextWrangler (For viewing sample codes from online)

Apache Web Server (phpmyadmin)

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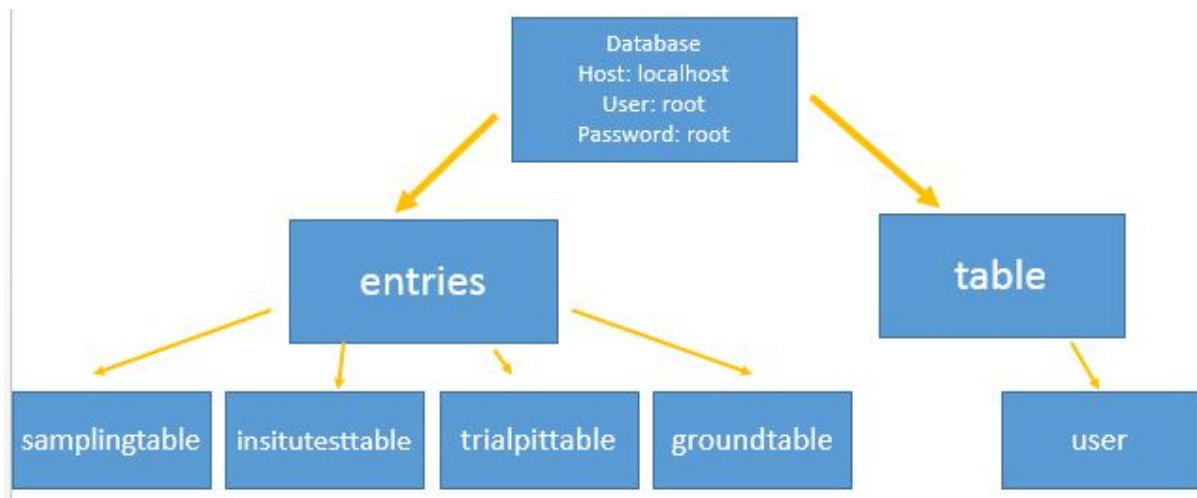
Soil Conditions Logging System

Server Side Scripting (PHP)

List of files

We create a database using MAMP.

Structure of the database:



SQL

- For user: table -> user

A database for user to authenticate to enter the app. It have columns named as 'username' and 'password'. The password was not encrypted



Intid, username, password

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- For sampling: entries -> samplingtable

A database for data entered from the sampling section of the app. It is also used to display on the table. It can update information into the following variables:

Samplingtable

ID, Borehole ID, TypeofSampling, StartDepth, EndDepth, ATT, GeologicalClassification, Strength, StrengthOptional, Color, ColorOptional1, ColorOptional2, ColorOptional3, SoilName, SoilNameOptional, ClassifierWeathering, Formation, Picture, TCR, RQD, SCR, Flag

- For ground water: entries -> groundtable

A database for information entered or updated from the ground water section. The values are input into the following variables:

groundtable

ID, BoreholeID, Date, Time, WaterDepth, Flag

- For insituation: entries -> insitutable

A database for information entered or updated from the in-situation test section. The values are input into the following variables:

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insitutable

ID, BoreholeID, TypeofTest, TestNumber, StartDepth, EndDepth, n1values, n2values, n3values, n4values, n5values, n6values, Nvalue, PenetrationDepth, GeologicalClassification, Strength, StrengthOptional, Color, ColorOptional1, ColorOptional2, ColourOptional3, SoilName, SoilNameOptional, ClassifierWeathering, Formation, Picture, Remoulded, Undisturbed, Flag

- For trial pit: entries -> trialpittable

A database for information entered or updated from the trail pit section. The values are input into the following variables:

Trialpittable

ID, Borehole ID, StartDepth, EndDepth, GeologicalClassification, Strength, StrengthOptional, Color, ColorOptional1, ColorOptional2, ColorOptional3, SoilName, SoilNameOptional, ClassifierWeathering, Formation, Flag

PHP

- Login.php

A php file for authenticating with database for the username and password.

- Get_data.php

A php file for the retrieving of data to display on the home page. The php have json location for the database's data to know where to display the information. It would then echo the values in the database to display.

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- Db_com.php
A php file for connection to the entries database.
- Inserting_sampling.php
A php file for inserting and updating information in sampling section. Instead of POST, we use direct commands like 'update' or 'insert' into the database to avoid the confusion between the variables that we used. Once it was successful, the message on the json_encode would be display on the app using AlertMessage.
- Inserting_groundwater.php
A php file for inserting and updating information in ground water section. Instead of POST, we use direct commands like 'update' or 'insert' into the database to avoid the confusion between the variables that we used. Once it was successful, the message on the json_encode would be display on the app using AlertMessage.
- Inserting_insitutestable.php
A php file for inserting and updating information in in-situation test section. Instead of POST, we use direct commands like 'update' or 'insert' into the database to avoid the confusion between the variables that we used. Once it was successful, the message on the json_encode would be display on the app using AlertMessage.
- Inserting_trailpitable.php
A php file for inserting and updating information in trail pit section. Instead of POST, we use direct commands like 'update' or 'insert' into the database to avoid the confusion between the variables that we used. Once it was successful, the message on the json_encode would be display on the app using AlertMessage.

Swift Xcode

- Reachability.swift
To check the internet connectivity to see whether the app is connected through wifi or mobile data or WAN or is disconnected. There is also a ReachabilityError in which it would have a list of what kind of error would happened. The swift file have a function where if the user is using local wifi, the app would authenticate with wifi, have an ip address and use it to send data to the server. The same goes for mobile data and WAN.If it detect a change of network, it would change appropriately for connection to work.
- AppDelegate.swift
A default swift file that allows you to do what a default app does.

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- ViewController.swift

An app page which includes a username text field and a password text field to prompt the user to enter. If either textfield is empty, it would send an alert to fill the blanks. Otherwise, it would show an alert for the wrong password or username being typed or there is no internet connection. If there is no error, the page would go to the HomeViewController. If you log out, it would show two empty text fields and you have to reenter the username and password to use again.

- HomeViewController.swift

A main page where the information in the database from sampling to trail pits would be display in section. There is a logout button for user to logout if they are done. The sections are synchronised with the server so if you hit the refresh button at the bottom of the page, there would be new information for whatever you entered into the section appearing. For editing or viewing purposes, you would have to pressed onto the particular table cell that you want to edit or view.

- SamplingController.swift

A page for Sampling. There are text fields for information input. You can edit and update using this. This page is also used for the displaying of the full information in the database. This is also used for the input of new information into the database. Once the user hit the Save button, the app would create a session for the connection for the server to encode the data, send the data over to the server and end the session once the data was sent over safety. it would display the status through Alert Message. The data was sent over using Constant.sharedInstance, the sharedInstance is when the app want to have a session with the server for an instant. It use the url in nsstring and the format is how the data would be sent to the server, the php files for the sending or editing, as well as the data entered into the textfield.

- InsituTestController.swift

A page for in-situation test. You can edit and update using this page. This is also used for displaying the full information in the database and also used for the input of new information into the database. Once the user hit the Save button, the app would create a session for the connection for the server to encode the data, send the data over to the server and end the session once the data was sent over safety. it would display the status through Alert Message. The data was sent over using Constant.sharedInstance, the sharedInstance is when the app want to have a session with the server for an instant. It use the url in nsstring and the format is how the data would be sent to the server, the php files for the sending or editing, as well

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as the data entered into the textfield.

- TrialPitController.swift

A page for trial pit. You can edit and update using this page. This is used for displaying the full information or inputting new information into the database. Once the user hit the Save button, the app would create a session for the connection for the server to encode the data, send the data over to the server and end the session once the data was sent over safely. it would display the status through Alert Message. The data was sent over using Constant.sharedInstance, the sharedInstance is when the app want to have a session with the server for an instant. It use the url in nsstring and the format is how the data would be sent to the server, the php files for the sending or editing, as well as the data entered into the textfield.

- BoreholeController.swift

A page for borehole. You can edit and update using this page. There would be an alert message to tell you whether you missed a necessary text field. This page is also used for editing, updating, displaying information in the database. Once the user hit the Save button, the app would create a session for the connection for the server to encode the data, send the data over to the server and end the session once the data was sent over safely. it would display the status through Alert Message. The data was sent over using Constant.sharedInstance, the sharedInstance is when the app want to have a session with the server for an instant. It use the url in nsstring and the format is how the data would be sent to the server, the php files for the sending or editing, as well as the data entered into the textfield.

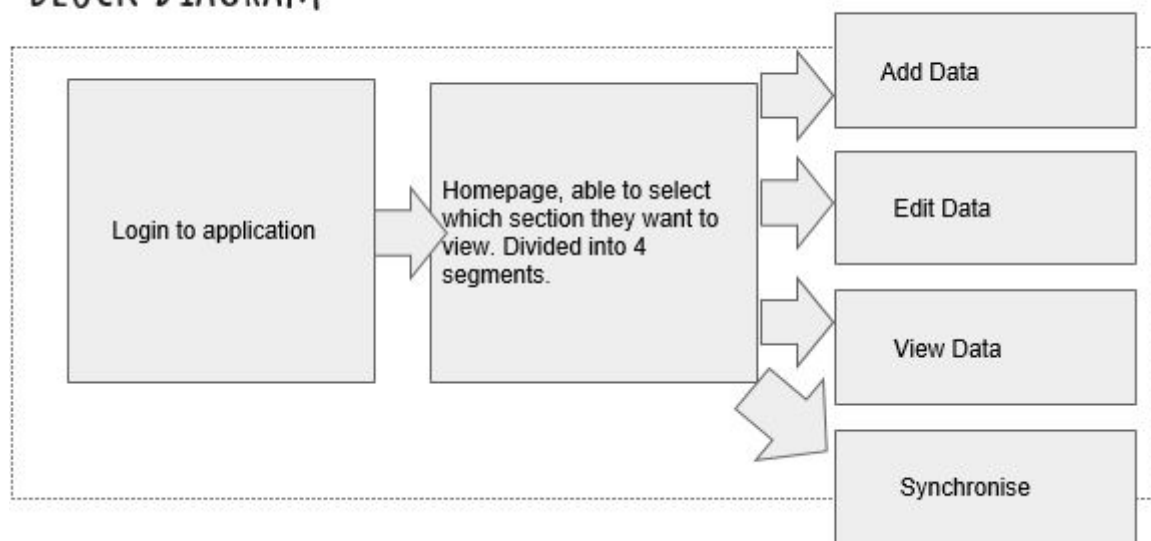
- Constant.swift

The function used for displaying alert messages and where the data is sent to the database and decoded using json is stored here. There is a variable for the php files used for the pages listed above. The php files connected to the variables in this swift files would be used to connect to their respective database. So for example, if constant's SAMPLING is used to connect php file which connect to sampling database, the Sampling app section coding would have to NSURL constant's SAMPLING to make changes or add information in the samplingtable database.

Chapter IV

How It Works

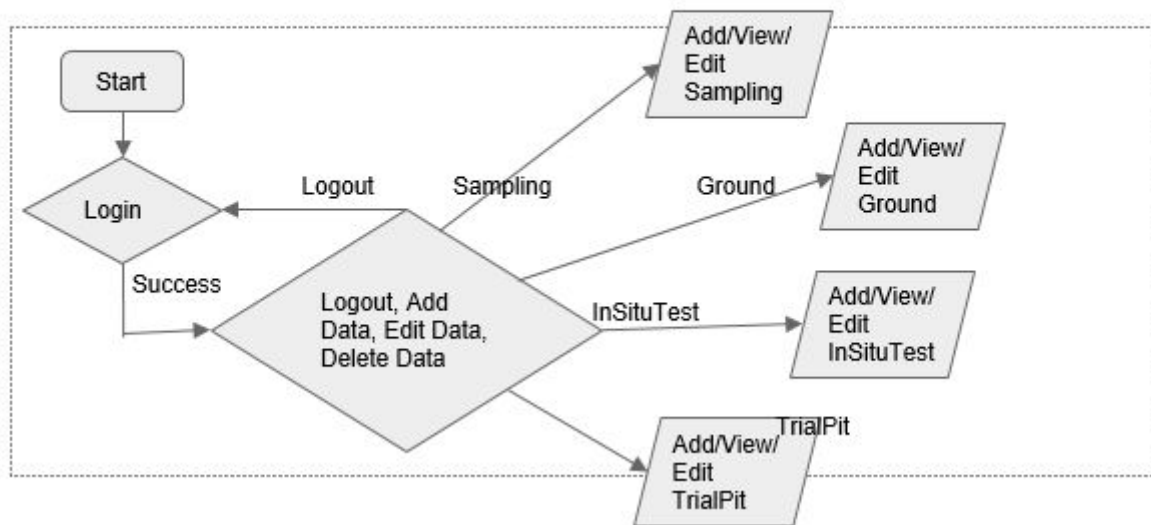
BLOCK DIAGRAM



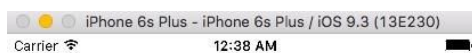
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FLOW CHART



IOS Application



LTA Borehole Logging

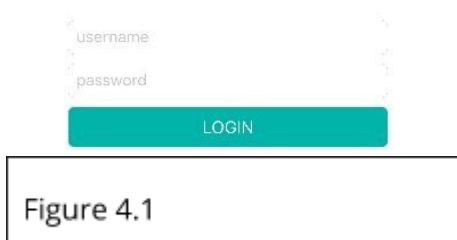


Figure 4.1

Login Page

Upon launching the LTA application, the login page (Figure 4.1) is the first screen you will see. The login screen is needed to only allow specific users to use and gain access to the data given to them.

To login, the user has to enter their username and password. This information will then be sent over to the server for verification. If the login is successful, the user will be forwarded to the project list page. If the login is not successful, an alert will be shown respectively in Figure 4.1.1, Figure 4.1.2 and Figure 4.1.3.



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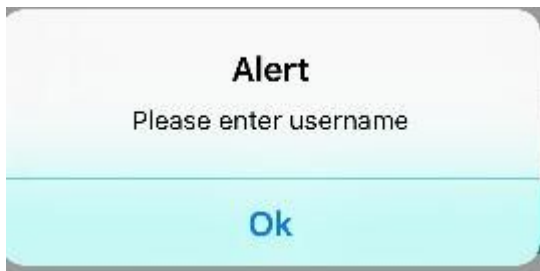


Figure 4.1.1

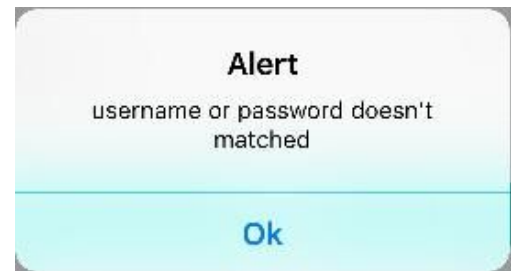


Figure 4.1.3

a

Carrier	9:53 PM	
Logout	Entities	+
Sampling	In-situ	Trial Pit
BoreholeID : 89 Type Of Sampling : TW		
BoreholeID : 90 Type Of Sampling :		
BoreholeID : 5 Type Of Sampling : high		
BoreholeID : 91 Type Of Sampling : TW		
BoreholeID : 86 Type Of Sampling : PS		
BoreholeID : 5 Type Of Sampling : fypassessment30		
BoreholeID : 5 Type Of Sampling : fypassessment30		
BoreholeID : 5 Type Of Sampling : fypassessment30		
BoreholeID : 5 Type Of Sampling : fypassessment30		
BoreholeID : 5 Type Of Sampling : fypassessment30		

Project List

The project list page(Figure 4.2) is displayed after successful login. This page shows various project the user has created.

The project screen displays the category for each list. The tabs are shown at the top, "Sampling", "In-situ", "Trial Pit", "Borehole".

Starting from the top, there are different buttons which will be detailed further on.

The LOGOUT button, when the user is done using the application, he/she can choose to logout from the application.

The ADD(+) button, where the user can create a new project which will be elaborate further later on.

The SAMPLING, IN-SITU, TRIAL PIT and BOREHOLE tabs, where projects are stored respectively as shown in Figure 4.2, 4.2.1, 4.2.2 and 4.2.3.

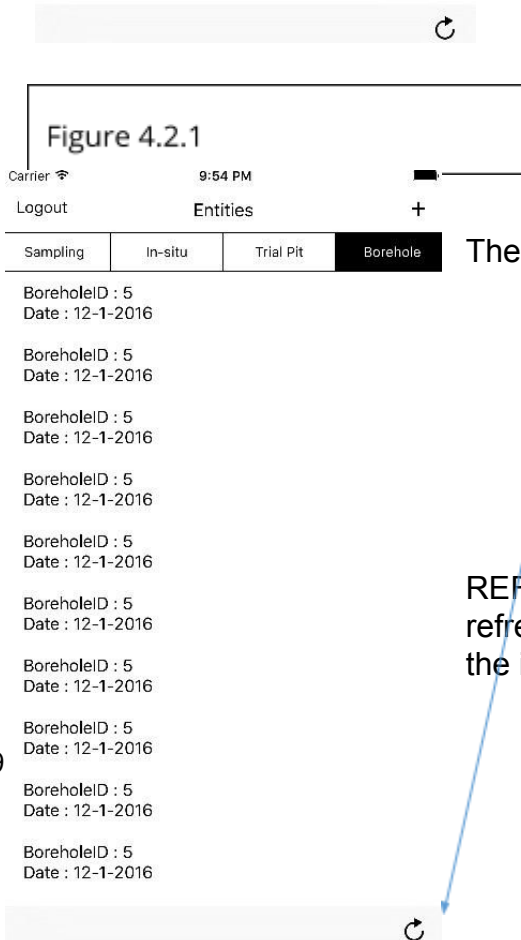
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Figure 4.1.2

Figure 4.2



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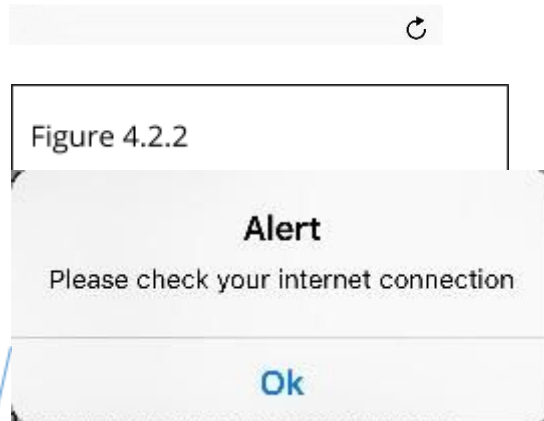


Figure 4.2.4

REFRESH button, is where the user can tap to refresh the page and to check its connectivity to the internet.

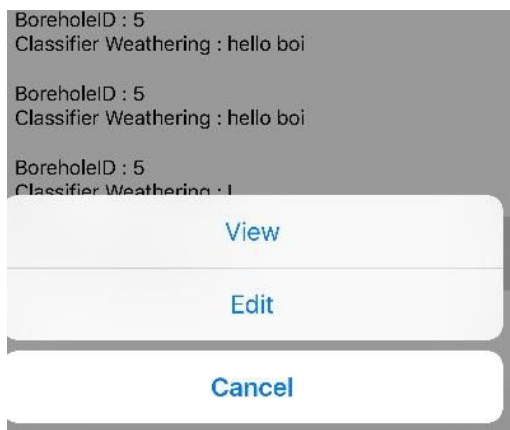
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In Figure 4.2.4, it shows a dialog, “Please check your internet connection”. This message is shown once the refresh button is tapped.

The project list is also scrollable. With this function, it is able to unveil more projects that are not displayed.

Figure 4.2.3



When the user clicks onto a chosen project, a pop-up screen will ask whether to “view”, “edit” or “cancel” as shown in figure 4.2.5. The “cancel” is to go back to the project list. The “view” and “edit” will be elaborated further later on.

Figure 4.2.5



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Add Project

After tapping onto the add (+) button from the project list, it will bring you to 4 choices, “Sampling”, “In-situ Test”, “Trial Pit” and “Ground” as shown in Figure 4.3.

Users can select the appropriate button for the respective project that they are doing or observing. The entries of each button will be further elaborated afterwards.

The BACK button, where users can go back to the project list (Figure 4.2) if they do not wish to create a new project.

Figure 4.3

carrier 10:00 PM

Back Sampling

Type of Sampling

Start Depth End Depth

6 10

Geological Classification

0

Strength Strength Optional

0 0

Color Color Optional 1

0 0

Color Optional 2 Color Optional 3

0 0

Soil Name Soil Name Optional

0

Classifier weathering Formation

0 0

Picture TCR

SAVE

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Edit Page / View Page

After tapping onto the edit button from the pop-up screen, it will show the entries that were saved originally as shown in Figure 4.4.

The BACK button, is where the user can go back to the project list if they chose not to make any amendments to the entries.

The user can then make any amendments from the original entry. Once the user is done making the amendments, he/she can save the updated entry. To show that it has successfully updated, a pop-up message will show “Updated successfully” as shown in Figure 4.4.1.

After tapping onto the view button from the pop-up screen, it will also show the entries that were saved originally.

Figure 4.4

Carrier 12:46 AM

Back In-situ Test

N5 Value	N6 Value
1	1
Geological Classification	1
Strength	Strength Optional
1	1
Color	Color Optional 1
1	
Color O	
1	
Soil Name	Soil Name Optional
1	1
Classifier weathering	Formation
1	1
Picture	Remoulded
1	1
Undisturbed	Flag
1	1

SAVE

Alert
Updated successfully
Ok

However, the only difference between the “view” and “edit” is that one only displays the entries while the other can display and make amendments.

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Figure 4.4.1

The figure displays two side-by-side mobile application screens. The left screen, titled 'Sampling', has a teal header with a 'Back' button and a 'Sampling' title. It contains a form with fields for 'Type of Sampling', 'Start Depth' (value: 6), 'End Depth' (value: 10), 'Geological Classification' (value: 0), 'Strength' (value: 0), 'Strength Optional' (value: 0), 'Color' (value: 0), 'Color Optional 1' (value: 0), 'Color Optional 2' (value: 0), 'Color Optional 3' (value: 0), 'Soil Name' (value: 0), 'Soil Name Optional' (value: 0), 'Classifier weathering' (value: 0), 'Formation' (value: 0), 'Picture', and 'TCR'. The right screen, titled 'In-situ Test', has a red header with a 'Back' button and an 'In-situ Test' title. It contains a form with fields for 'Type of Test', 'Test Number', 'Start Depth', 'End Depth', 'N Value', 'Penetration Depth', 'N1 Value', 'N2 Value', 'N3 Value', 'N4 Value', 'N5 Value', 'N6 Value', 'Geological Classification', 'Strength', and 'Strength Optional'. Both screens have a teal 'SAVE' button at the bottom.

Adding an Entry

Each of the pages are categorized into four different projects as shown in Figure 4.5. Each of these pages might look similar but are different in terms of type of data that is stored.

There is a back button where the user can choose to exit or to choose another project.

The page is also scrollable because there are many blanks to fill in.

Once the user is done creating the entry, he/she can tap on the save button. The entries will then be sent over to the server to store the data and the user will be directed back to the project list.

Figure 4.5

The figure shows a mobile application screen with a yellow header containing a 'Back' button and a 'Ground' title. The screen displays a form with fields for 'Date' (DD / MM / YYYY), 'Time' (HH:mm), 'Water Depth', and 'Flag'. A teal 'SAVE' button is located at the bottom of the screen.

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The following page is a picture of the expected Borehole Logging Project Data Sheet that will be stored in our Database

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Soil Conditions Logging System

PROJECT NO:										BOREHOLE NO:							
LOCATION:										NORTHING:							
										EASTING:							
										REDUCED LEVEL:							
IN-SITU TESTS DATA		SPT N VALUE								SPT(N)/mm	REDUCED LEVEL(m)	DEPTH (m)	SAMPLE TYPE	THICKNESS (m)	GEOLOGICAL CLASSIFICATION	DESCRIPTION	
		10	20	30	40	50	60	70	80								90
Ground Water Observation		Time	BH Depth	CS Depth	Water Depth	ATT - ATTEMPT MLPS,TW,LD				FES - CASAGRANDE PIEZOMETER							
Boring Type:						CR - CORE RUN				SPT - SPT N VALUE							
DIAMETER(mm):						ML - MILLER SAMPLE				TW - THIN WALL PUSH IN							
						PET - PERMEABILITY TEST				LD - THICK WALL OPEN DRIVE							
						PST - PUCKER TEST				VST - VANE SHEAR TEST							
						PRM - PRESSUREMETER TEST				WSP - WATER STANDPIPE							
						PS - PISTON SAMPLE											
CLIENT:																	
PROJECT:										LOG OF BORING							
										GEOTECHNICAL STUDY-FIELD INVESTIGATIONS							
CONTRACTOR:										LOGGED BY:			DATE OF FIELD WORK				
										CHECKED BY			SHEET NO				

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The following page is a photograph taken of an official Land Transport Authority
Project Data Sheet

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PROJECT NO: SIL/S7406-2/14/S1		BOREHOLE NO: RC7011									
LOCATION: Punggol Central (In Front Block 162A)		NORTHING:									
		EASTING:									
		REDUCED LEVEL: 105.64 m									
IN-SITU TESTS DATA		SPT N VALUE		SPT(N)/mm	REDUCED LEVEL(m)	DEPTH(m)	SAMPLE TYPE	THICKNESS (m)	GEOLOGICAL CLASSIFICATION	DESCRIPTION	
		10	20								30
Trial Pt: 1.00x0.80x1.00m Hand Auger: 1.00-3.00m											
SPT1: 3.00-3.45m 1/1/2/3/3		<div> <div>103.64</div> <div>2</div> <div>2.00</div> <div>FILL</div> </div>									
SPT2: 5.00-5.45m 1/1/5/1/1/1		<div> <div>9/300</div> <div>102.64</div> <div>3</div> <div>SPT1</div> <div>1.00</div> <div>FILL</div> </div>									
SPT2: 5.00-5.45m 1/1/5/1/1/1		<div> <div>8/300</div> <div>100.64</div> <div>5</div> <div>SPT2</div> <div>2.00</div> <div>FILL</div> </div>									
TW1: 7.00-7.90 Rec: 60cm		<div> <div>98.14</div> <div>7</div> <div>2.50</div> <div>E</div> </div>									
SPT3: 7.90-8.35m 1/1/2/1/1/1		<div> <div>5/300</div> <div>96.14</div> <div>8</div> <div>SPT3</div> <div>2.00</div> <div>F2</div> </div>									
TW2: 9.00-9.90 Rec: 50cm		<div> <div>96.14</div> <div>9</div> <div>2.00</div> <div>F2</div> </div>									
SPT4: 9.90-10.35m 1/1/1/1/1/1		<div> <div>4/300</div> <div>92.64</div> <div>10</div> <div>SPT4</div> <div>3.50</div> <div>O(E)</div> </div>									
SPT5: 11.00-11.45m 0/1/1/1/1/1		<div> <div>4/300</div> <div>90.64</div> <div>11</div> <div>SPT5</div> <div>4.00</div> <div>O(E)</div> </div>									
SPT6: 13.00-13.45m 1/1/1/2/2/2		<div> <div>6/300</div> <div>86.64</div> <div>13</div> <div>SPT6</div> <div>4.00</div> <div>O(E)</div> </div>									
TW3: 15.00-15.80 Rec: 75cm		<div> <div>90.64</div> <div>15</div> <div>2.00</div> <div>O(E)</div> </div>									
SPT7: 15.80-16.25m 3/3/3/2/2/3		<div> <div>10/300</div> <div>86.64</div> <div>16</div> <div>SPT7</div> <div>4.00</div> <div>O(E)</div> </div>									
SPT8: 17.00-17.45m 1/1/2/3/2/2		<div> <div>9/300</div> <div>86.64</div> <div>17</div> <div>SPT8</div> <div>4.00</div> <div>O(E)</div> </div>									
SPT9: 19.00-19.45m 1/1/2/2/2/3		<div> <div>9/300</div> <div>86.64</div> <div>19</div> <div>SPT9</div> <div>4.00</div> <div>O(E)</div> </div>									
Ground Water Observation		<div> <div>Time</div> <div>BH Depth</div> <div>CS Depth</div> <div>Water Depth</div> </div>									
Boring Type: Rotary		<div> <div>09:00</div> <div>1.10</div> <div>6.00</div> <div>45.50</div> </div>									
DIAMETER(mm): 100.0		<div> <div>ATT - ATTEMPT</div> <div>MZ - MAZIER SAMPLE</div> <div>PET - PRESSURE TEST</div> <div>PCT - PACKER TEST</div> <div>PS - PRESSURE METER TEST</div> <div>PS - PISTON SAMPLE</div> </div>									
CLIENT: Land Transport Authority		<div> <div>PZS - CASAGRANDE PIEZOMETER</div> <div>SPT - SPT'S VALUE</div> <div>UD - THICK WALL OPEN DRIVE</div> <div>VST - VANE SHEAR TEST</div> <div>WSP - WATER STANDPIPE</div> </div>									
PROJECT: ER463 - SI Works from Tuas to Changi (WO 1E04)		LOG OF BORING									
CONTRACTOR: Soil Investigation Pte Ltd		GEOTECHNICAL STUDY-FIELD INVESTIGATIONS									
		LOGGED BY: Nay Tin Zaw Win					DATE OF FIELD WORK: 11/12/14 - 16/12/14				
		CHECKED BY: Tang Bee Lin					SHEET NO: <1>/<3>				

Chapter V

Conclusion

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Soil Conditions Logging System

The creation of our project, the iOS Soil Condition Logging System has been an overall success for our team. We have managed to replicate the Android application with an improved UI (User Interface) in order to improve simplicity and diversity.

Currently, our server is on a localhost, MAMP. Hence implementing the server onto a proprietary server should be our next step. There are two options that we can use. Either by enlisting a third party host with maximised security (CISCO) or LTA can use a server host within the LTA Enterprise network.

At this stage, further implementations such as image uploading algorithm, GPS Location tracking and saving locally to our phone memory should be our next step of implementation for the application. Further tests are required to enhance the reliability of our application in order to smoothen out glitches and bugs.

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Soil Conditions Logging System

Future Improvements

- Able to add extra layers as an entry to indicate soil changes.
- Termination depth to indicate completion of borehole.
- In borehole details, add a grouting ratio,
Cement : Bentonite : Water - 1 : 2 : 3
- We would like to add the timestamp window for users to login using the application as their signing in for their attendance for work. The GPS function will allow the company to check whether the person did sign in at home or at the designated location.
- PDF layout generation can be improved.
- GPS Function for location tracking.
- Display different units (m/cm/mm/micrometer) for depth inputs.

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Soil Conditions Logging System

References

Summary of list of skills needed to learn for readers who are interested to do such or similar project:

Swift 2.2, PHP 5.7, MySQL

NetBeans, MAMP, Xcode Swift 2.2

<https://www.mamp.info/en/>

<http://swiftdeveloperblog.com/>

<https://netbeans.org/>

<https://swift.org/blog/swift-2-2-released/>

<http://stackoverflow.com/>

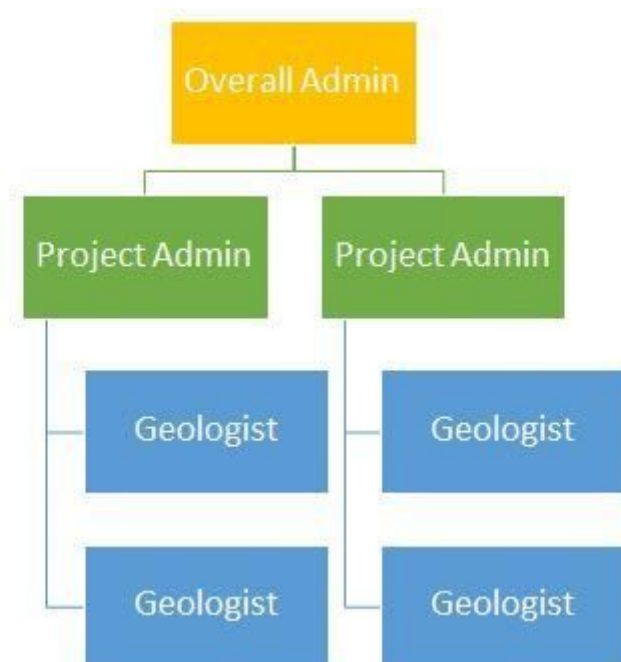
<http://www.w3schools.com/>

<http://php.net>

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Soil Conditions Logging System

User Appendix



User Hierarchy

- Overall Admin
 - Manage project
 - Assign/delete Project Admin
 - Assign/delete Geologist
 - Create/delete/edit project
 - Manage boreholes
 - Create/delete/edit borehole
 - Manage user accounts
 - Create/edit/delete account
 - Set account privilege level
 - Reset password

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Soil Conditions Logging System

- Privilege level 3 (Able to do anything, oversee the overall data changes)
- Project Admin
 - Project updates
 - View project updates
 - Notification for project updates
 - Manage boreholes
 - Create/delete/edit borehole
 - Assign/delete geologist
 - Produce pdf
 - Privilege level 2 (Read Write Execute for overall project-based)
- Geologist
 - Enter data for borehole
 - Edit data for borehole
 - Privilege level 1(Read, Write for application-based)
- General Users (Everyone)
 - Login/logout
 - Change password
 - Level 0 (user level)

End Of Report