Carnegie Mellon University Qatar

Software Development Project
67-373, Spring 2017
Final Report Requirements

In this final report, your team will describe the background and outcomes of your project. Note that this is a general template --- one size will *not* fit all. Tailor your report according to the nature of your project keeping the spirit of this template in mind. The final report consists of two major parts: the executive summary, which must be two pages long (and no more than two pages) and the project report.

DRAFT REPORT DUE DATE: Thursday, April 20th, 2017 at 11:59 PM
SUBMIT: As a Microsoft Word document to the draft report folder in Blackboard.

FINAL REPORT DUE DATE: Tuesday, April 25th, 2017 at 11:59 PM
SUBMIT: As a Microsoft Word document to the final report folder in Blackboard.

Cundall Beyond report

Presented to

Cundall

Hala Yousef, Amie Shuttleworth, Donald Slade, Ahmed Mohammed

20th April, 2017

Ali Jafar, Mohammed Zakaria, Muhsin Warfa

Prepared for
CMUQ 67-373 Software Development Project Course
Spring 2017

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Cundall Beyond Report
Executive Summary

Community Partner
(Donald Slade), (Amie Shuttleworth), (Hala Yousef), (Ahmed Mohammed)
Cundall
Student Development Team
(Ali Jafar), (Mohammed Zakaria), (Muhsin Warfa)
Spring 2017

Background

Cundall is a multi-disciplinary consultancy firm which focuses on sustainable engineering. To promote sustainability in the organization and to the client, Cundall uses the beyond report. The beyond report generates sustainable report depending on the project type chosen. Later on, the client receives the report to implement the sustainable practices in the project.

Project Description

Being world's first consultancy firm to be endorsed as a One Planet company, Cundall uses the beyond report excel sheet to implement sustainable practices in all the projects. The beyond report consists of 10 basic sustainable principles based on WWF. Depending on the project type, Cundall proposes sustainable practices through the beyond report excel sheet.

Project Opportunity

Although the beyond report excel sheet provides important information about the sustainable practices of the project. However, the beyond report sits as an excel file in the company's server which reduces its accessibility form outside the company. It also lacks on providing history of previously generated reports. In addition, modification of the excel sheet was rigorous and the use was limited to only computers. Finally, it required precaution to protect the excel sheet as it had limited security and privacy.

Project Vision

The project aims to enhance the sustainable practices report generated by Cundall to provide more accessibility, flexibility among devices, more security, easy modification and finally have audit trail of the process.

Project Solution and Outcomes

Both the client and the development team felt the need to develop a web-application for the beyond report in order to enhance the sustainable practices. The web application will increase accessibility of the report to Cundall global, it will also provide better security and control to the employees and admin. It will also provide more flexibility of the application across devices and easy modficiation. From people and process perspective, the solution will help users to generate reports more effectively and increase the number of people using the Beyond Report.

Project Deliverables

Cundall will be provided with the full administrator access for the Beyond Report web-application. The project will be deployed on wordpress engine for which the subscription will be hosted by Cundall. Cundall will also be provided with the project documentation and manual for using the application.

Project Sustainability

As there exists lack of advanced technological infrastructure and IT staff in Cundall, therefore the project has been developed accordingly. So, the application has focused more on the easy drag and drop features over programming. In addition, the project has been integrated with different plugins to handle the backend database in phpmyadmin. As the the application will be deployed on wordpress, therefore Cundall will have access to various online open source tools and documentation in addition to the available expertise.

Student Development Team

The web-application has been developed by three Information Systems junior students in Carnegie Mellon University-Qatar. A brief introduction of the student team is given below:

Mohammed Zakaria has served as project manager and head programmer. He is a third-year student majoring in Information Systems with Business minor. He is looking into Tech-Entrepreneurship and marketing after graduation

Ali Jafar is the head of documentation, assistant programmer and team's spokesman with the client. He is a third-year student as well majoring in Information Systems with Global Systems track. He is interested into technological and design career path.

Muhsin Warfa is the UI Designer for the Home page. He is a third-year student majoring in Information Systems.

Cundall Beyond Report

Community Partner Background

Cundall is an international multi-disciplinary consultancy company that was first established in the UK, 40 years ago. It is now operating from 20 locations across the globe for instance Australia, Asia, Europe and Qatar. It consists of more than 700 staff members around the globe. Two branches are located in Qatar with a total of 60 staff members. All these global branches need to be able to collaborate with each other in order to work effectively as a company. Cundall was established in Qatar in the year 2011.

Cundall provides engineering consultancy services to their building projects. Services include *Building Services Engineering*, *Civil Engineering*, *Structural Engineering* and *Sustainable Design*. *In every project, Cundall focuses on the aspect of sustainability* even if their clients don't plan to build a sustainable design. By becoming a sustainable company, Cundall can provide 'total solutions' that saves time, money and effort.

In terms of Information Systems, all the projects in Cundall needs to satisfy their clients. So they rely heavy on what the user thinks of their approach so if they are designing a building, they have test their design approach with their clients to get a sense if the design is able to move on.

About the Team

The team consist of three Information Systems junior students at Carnegie Mellon University-Qatar who carry a different set of skills. They are Ali Jafar, Mohammed Zakaria and Muhsin Warfa. Mohammed Zakaria took the lead of this project and was the project manager. He made sure that everyone would regularly meet to discuss how to proceed with the project. Every team member kept communication with each other very frequently by setting up group

meetings. In addition, Ali Jafar was the spokesman for the development team with Cundall. He was in charge of providing the progress reports and arranging weekly meetings at Cundall's office or video conference.

Ali Jafar took the role as the head of documentation who contributed the most in every document required throughout the project. Mohammed Zakaria and Muhsin Warfa both helped with the documentation by providing distinctive ideas on certain parts of the documentation. Mohammed Zakaria played a major role in reading over the final documentation files before its submission to make sure nothing was missing.

Mohammed Zakaria took the lead of developing the software in this project. He mainly focused on creating the core functionalities of the application. Ali Jafar took charge of developing the first demo of the application since he wanted to develop the start of the application. After the first demo, Mohammed Zakaria has developed all the core functionalities. Muhsin Warfa mainly focused on the user interface of the application after most of the core functionalities were operational. Towards the end of the project, Mohammed Zakaria and Ali Jafar transferred all the data from the excel spreadsheet to their application. They split up the data entry where Mohammed Zakaria took the liberty of inputting 10 forms worth of data and Ali Jafar the other 10 forms.

Community Partner Project Description

Project Opportunity

Cundall have developed the 'Beyond Report' which is vital to their company as it provides a competitive advantage over other organizations. The purpose of this 'Beyond Report' is to enhance awareness and implementation of sustainability practices to all Cundall employees, within the organization. The report is a consultancy plan where they input information on how they will proceed with their project, with their clients. This report is developed in Microsoft excel and staff members have been using it around the beginning of 2016. The report is deployed in the intranet, in the local database where any Cundall staff member can access and use it around the world.

The problem arises is that even though the 'Beyond Report' is relatively easy to access, a lot of staff members still don't use this for their projects. Cundall wants more people to use this and it can teach them about sustainability and the importance of it. Right now the 'Beyond Report' is a large file with lots of text, drop down menus and not an appealing user interface. As there are tutorials in the intranet for staff members to watch in order to understand the report, but they

believe that this is time consuming and too expensive to set up. Finally, the clients would want this report to be accessed on their phones, outside their office from the Cundall server. As the report is developed on excel, this cannot be accessed on a phone.

Other problems include that the report can only be accessed via Cundall's intranet. Accessibility is limited as they cannot use it outside the office. Since all the data within the excel spreadsheet is vital to their company, risk of losing the data is high. Right now the security and the control of the data within the excel spreadsheet is limited. Since the Beyond Report is developed in excel, it can only be accessed and used on a laptop. Cundall employees don't have the ability to use this report on their phones for instance.

Finally, modifying the spreadsheet was rigorous and challenging. It required the user to have prior knowledge on macros to add or edit new data without disrupting the previous data. It's a long process and the skills for it was limited to the administrators only.

Project Vision and Objectives

Project Vision: The application mainly focuses on minimizing the time and effort required to create sustainable reports while integrating the whole system together for better efficiency and transparency. It also aims to increase the number of the users committed to the application.

Both Cundall and developers shared the same project goal which was to convert the excel spreadsheet into an application that provides the Cundall employees with an improved work flow and enhance flexibility. By creating an application with a new user interface, it can engage the Cundall employees within the application. They can regularly start generating reports for every project they work on. As they are engaged using the application, they can learn the company's sustainability practices and they can understand why the company is pushing towards a more sustainable approach.

The application will be used by all Cundall employees around the globe, not just in Qatar. Approximately 700 staff members across 20 countries may be using the application. The team decided to create the application using WordPress with all the core functionalities implemented.

Project Solution and Outcomes

Process:

When selecting the solution, the client addressed the background of promoting sustainable practices in Cundall and the issue of various constraints towards the goals. Many technical solutions were provided to solve this problem but the client highly emphasized that there is no IT staff present in Cundall Qatar so the solution must be easily maintained by someone who has no knowledge in software development. The client therefore agreed on what the application requirements were required and the development team looked at which software they would use and why. Please look at tables 1 and 2 below to get a better understanding.

Table 1	**Deployed on any laptop OS i.e. Windows, macOS**	**Deployed on mobile platform i.e. Android, iOS**	**Easy for Cundall staff to update application without any IS background**
Mobile App	×	✓	×
Ruby on Rails	✓	✓	×
WordPress	✓	✓	✓
Wix	✓	✓	✓
Microsoft Access	✓	×	✓

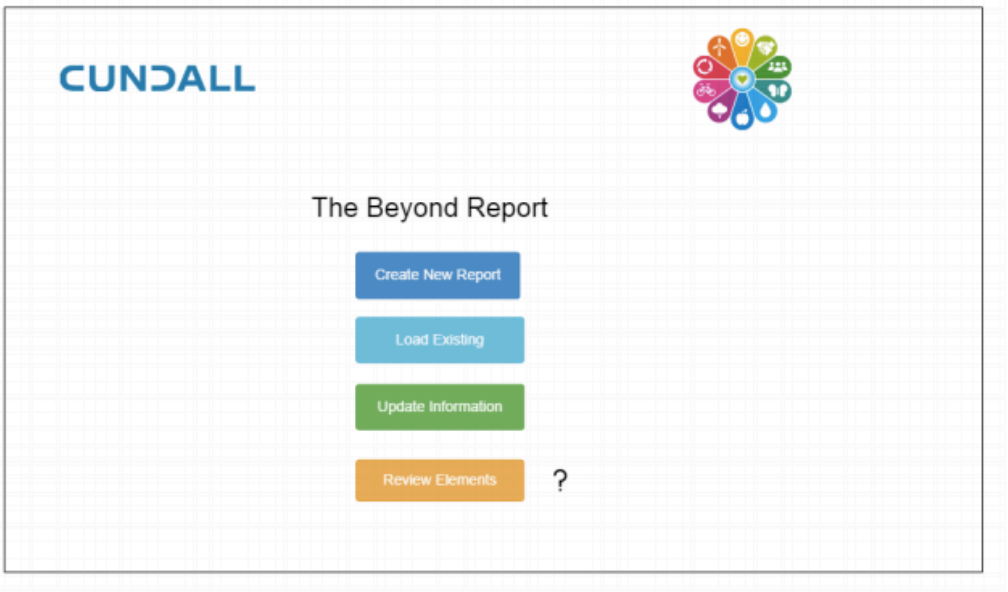
In the end, the development team plan to implement the 'Beyond Report' using WordPress. This is because it's a free software where non-programmers can easily learn. As the Cundall staff members have limited knowledge in programming, they can spend a while learning about WordPress before they update the application. Also, all the requirements can be carried out by adding plugins into the application. The team researched in WordPress and found that by installing plugins, they could carry out almost all the requirements. It can also be deployed on all laptop and phone operating systems. But more importantly is that Cundall's IT team is only located in their main branch, UK, the team decided to avoid programing the application from scratch. It would be easier for Qatar's staff members to maintain and update the application in WordPress, as its easier to learn compared to a programming language.

The team followed the Waterfall development methodology while working on this project. In this development methodology, the **first step** was to confirm all the requirements of the application. The above tables show all the requirements that the application needs to be implemented. Some of these requirements were directly taken from the excel spreadsheet and some were added from the clients to enhance the application further.

The **second** step was to create the design of the application. The user interface of the excel

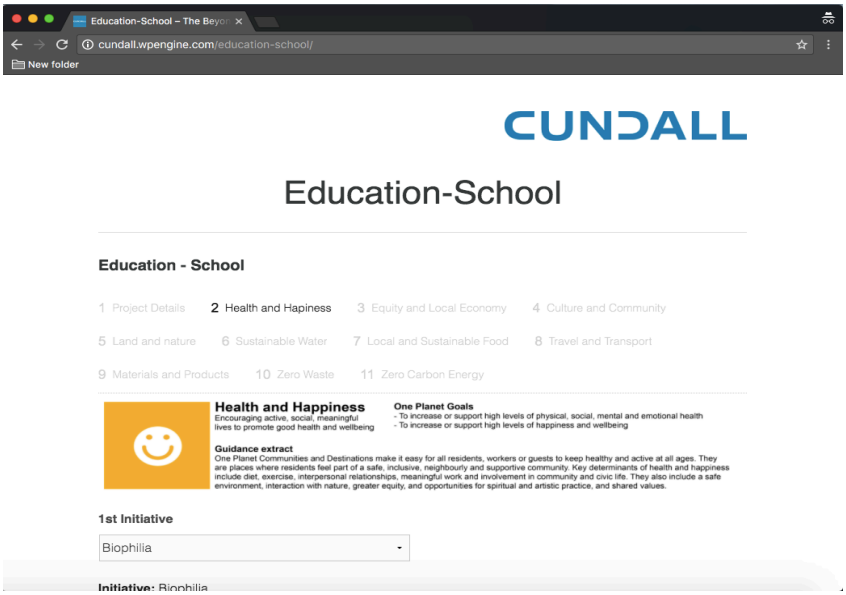
Table 2	**Admin & Regular User**	**Login**	**Choose pre-defined recommendations**	**Generate Report**	**Export report in pdf**	**Autocomplete fields**	**Admin allowed to add new data**
Mobile App	✓	✓	✓	✓	✓	✓	✓
Ruby on Rails	✓	✓	✓	✓	✓	✓	✓
WordPress	✓	✓	✓	✓	✓	✓	✓
Wix	✓	✓	×	×	×	×	✓
Microsoft Access	×	×	✓	×	×	✓	✓

spreadsheet was not user friendly so the clients wanted an improved interface design. Both the team and the client had multiple user interface designs in mind. The client sent over a few sketches of the different pages of the application on how they wanted the user interface to look like. The team considered their ideas and created mockups of the designs using their initial designs as well. The team sent their UI's to the client to verify them.



Home Page

The **third** step is to implement the application with all the functional and feature requirements. By considering which functional and feature requirements that clients needed, the team developed all these requirements in WordPress. They even transferred all the data from the excel spreadsheet to the application itself.



The **fourth** step is to verify the application so this is where Cundall employees test out the application developed by the developer real-time. More information about the test for the application and the results are provided below in the 'Testing Report' section.

The **fifth** step is the deployment and maintenance of the application. Since the application was running on wpengine on CMUQ's server, Cundall will purchase this deployment model in order to run the application locally and globally. Wpengine is preferred because the team is certain that everything will run smoothly when WordPress is deployed here and all the data is backed up. And for maintenance, we will deploy the application on wpengine and hand over the entire application to the client where they will be responsible on the future of the application. The team has developed a screencast and a help section within the application in case the staff members are having difficulties generating reports for example.

Solution:

A web application was developed on WordPress, as mentioned before, that can be accessed via laptop and mobile. It follows the MVC (Model, View, Control) framework because it provides flexibility when using phpMyAdmin to insert the data and retrieve it through the plugins. The core functionalities include different user roles and authentication. There are two types of users, the admin and regular Cundall employee. Before accessing and using the application, they have to login first. Their username and password must be authenticated because all the data is valuable within the application and we don't want unauthorized users accessing the application and stealing the data.

The admin and regular user are able to generate reports. They have to select which project type and fill in the necessary details i.e. project name, Cundall role, date etc. The user has to go through all 10 sustainability practices and choose their rightful initiatives. The application auto-generates the top 3 initiatives of the project type including its goal, examples, details and possible synergies. The user has the ability to select another initiative from the drop down menu and/or enter their own initiative (and goals, examples, details and possible synergies) by clicking the 'bespoke option'.

After submitting the report, any user can download their report as a pdf. They can directly print the report or send it to their clients. Once reports are generated, it automatically gets stored within the application. By clicking on the 'Load Report' button, you can see all the reports that were created by multiple users. The user has the ability to edit their own report, after generating it, if they feel like they did a mistake and want to change an initiative for instance.

The admin has the ability to approve and disprove reports from regular users. The admin can look through all the reports and click either to Approve or Disapprove a report allowing the users to know which reports can be used for the future and which shouldn't. The admin also has the ability to go to the back end of the application and add new forms and edit the old

forms. They can also change the HTML/CSS of the application if they want a complete new interface design in the future. The admin can create new users and provide their staff members with a username and password to use the application. After the staff member logs in, they have to reset their password.

There is a demo screencast that was sent to the clients that shows a video on how the application works. There is also a user manual created for the clients that shows steps on how to generate reports, download report as a pdf, load reports etc.

Testing report:

The team carried out unit testing, integration testing and system testing of the application. Since the application was mainly developed on the cloud, using wpengine, the client was given a username and password so they can access the application from their office.

The table below shows all the testing that was initially planned and the following results.

Test Case ID	Test Case Summary	User Story	Result
TC001	To verify if only Cundall staff members are able to login to the application and if its secure.	"To have an authentication system so that unauthorized people cannot have access to the report and database".	The tests have passed and users with correct credentials are provided access while others are blocked to access the website.
TC002	To verify that filling out the form, by choosing the right fields, is able to generate a report.	"As a Lead Consultant, I would want to generate reports so that I can advise clients accordingly and give the best sustainability options for their project with the luxury of accessibility of the database without having to only use it in the office".	The initiatives generated were fully dependent on the project type. Initiatives which were absent in certain project type were not displayed in the form as well.
TC003	To verify if the ranking feature in the database is incorporated correctly in the forms.	"A user can be able to see top 3 recommended initiatives for sustainability these are the recommendation provided by Cundall using a specific ranking algorithm".	The ranking of the initiatives was assigned depending on the projec type chosen. The website worked similar to the excel sheet.
TC004	To verify that once after the report is generated, it can be generated into pdf, to a client within the application.	"As a Fire Engineer I would want to be able to send pdf immediately to clients through email so that the process of sharing information becomes faster".	The application supported pdf generation of the report and it's functional from mobile platform as well.

TC005	To verify that once a report is generated the ranking feature is incorporated properly.	“As a Cundall consultant, I want the app to generate report related to the project so that I can consult the client really quick”.	The application provides a brief summary page after the form is submitted with the capability to modify the form later.
TC006	To verify that the flow of the application from user authentication, to creating and/or generating a report, ranking of the data is working perfectly and emailing the report to the client works affectively.	“As a new employee at Cundall, I want to use the application with ease so that I can serve the client fast and easily”.	All the links and home buttons were functional and there were no dead ends present in the application. Therefore, the flow of the application was proper and verified.
TC007	Admin is able to add new data within the database	“As a senior Sustainable Manager, I want to add new sustainable practices in the app so that Cundall can keep up with newest sustainable research and practices”.	Through review elements, the admin were provided access to the back-end of the forms while regular users were blocked.
TC009	Admin is able to create a new user and provide it to the staff member.	“As a head of sustainability, I want to add new users to the application so that the newly employed employees have the access to the web app”.	Administrator were able to add several users and assign roles depending on the users. Regular users were disabled to add other users.

Final Project Deliverables

Application: The entire application has been developed and hosted in the wordpress engine. The link for the website is https://cundall.wpengine.com/ . During the development, the access for the website was only limited to Mrs. Hala Yousef and Mrs. Amie Shuttleworth. They were responsible for adding other Cundall employees to the website. As a backup, it has also been pushed to BitBucket for which the developers have access to the repository. The BitBucket repository was created by Ali Jafar and it is under the folder name ‘JuniorProject’.

Tutorials: Step by step user manuals has been provided in the “Training Materials” below. The manual will help the users to perform basic tasks in the application. Mrs. Hala has also been provided with walkthrough video of the application for performing all the essential tasks. Basic help has also been provided in the website. Cundall can modify the help documentations in the website according to their needs.

Documentations: Cundall was also provided with all the necessary documentations for the project. The main documentations for the project includes project requirement and proposal, project plan, project design, sustainable report and finally the project report itself.

Project Sustainability

Developer: As the application has been developed in Wordpress engine, therefore it doesn't require the users to have advanced knowledge on programming to maintain the application. Most of the functionalities of the website mainly consists of drag and drop. As the application is created on an open source tool, the developer can learn anything on WordPress by searching the internet. The developer doesn't need to know any programming skills in order to update or maintain the application. But if they don't know how to work with WordPress then they need to invest a good amount of time to understand how the core functionalities work, of the application. They can watch tutorials online to understand how WordPress works and how they can change the CSS design of the application, if they want to. The developers are also encouraged to use the user documentation and manual for modifying the application. The user document explains how to navigate the application and how to generate the report, print and email the report, edit your current report, view all the reports, approve and disapprove of reports.

Users: The application mainly consists of 3 users which are staff members, contributor and administrator. The **staff members** are the most basic users who have access to generate reports, load existing reports and modify the ones they've created. They don't have any access to the back end of the application. **Contributors** are employees who in addition to the staff members have the ability to modify the forms and the settings. They have limited access to the back-end. Finally, **administrators** have the full access to the website and can add or remove any users they want. All the users will have access to basic user manual for reports, while admin and contributor will have access to modifying form and admin settings.

Infrastructure: Cundall have access to the screencast of the application that explains how the functionalities work and a user manual that shows tutorials on how to use the application as an admin perspective and regular user perspective. The clients have had training from the development team where they showed them how the application works in the back end. Within the application, there is a help button where a staff member can click to if they don't understand a certain function that provides contextual help. Cundall is suggested to develop policies containing terms and condition applied to use the application. These policies will help the client, employees and its customers to utilize the application for which it's being initially

developed. Any breach from the policies established by the client can have consequences implemented by the admin.
In terms of support, if the Qatar staff members are having trouble paying or if the deployment of the application isn't working properly as they anticipated, they can contact their IT team in the UK. Since their IT members are very skilled they can remotely fix the problem since the hosting website is on the internet.

Training Materials/Manuals

Attached with the submission.

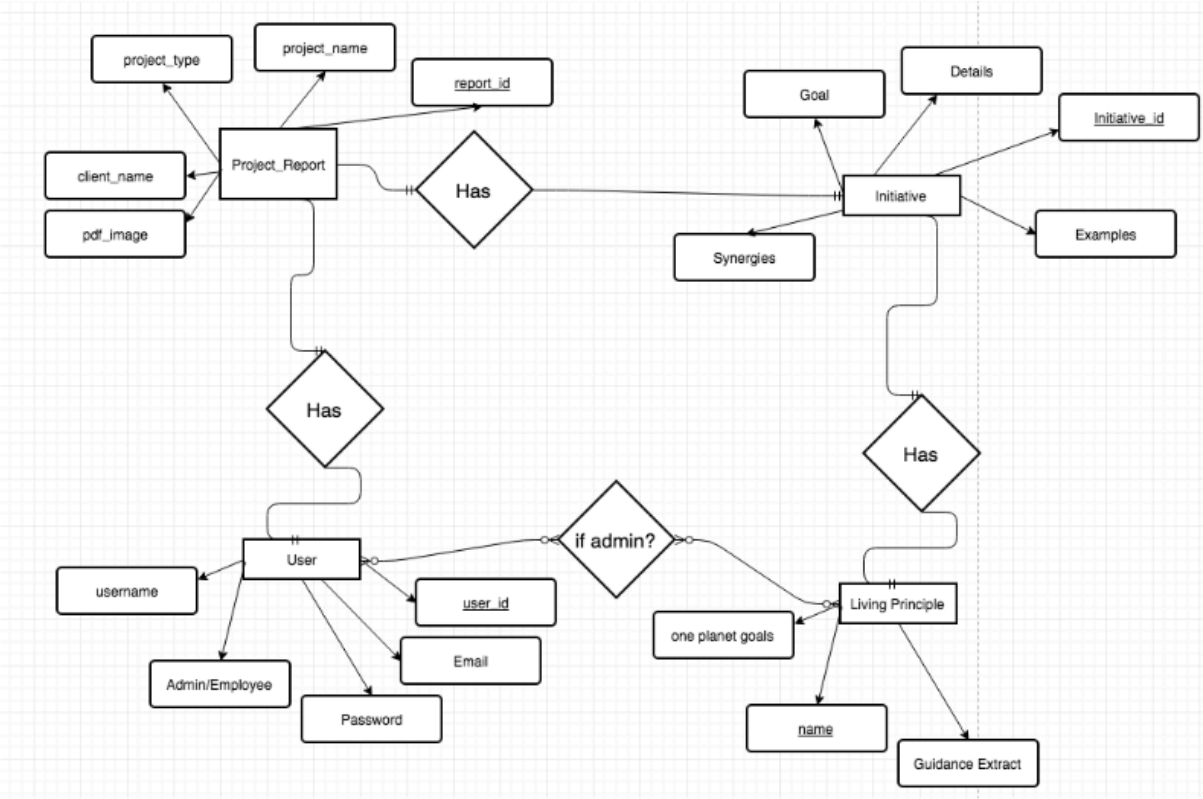
References

- Company profile has been taken from their website. Retrieved from http://www.cundall.com/About-Us/About-us.aspx
- Schein, E. H. (1969). Process consultation: Its role in organization development.
- Williams, B., Richard, O., & Tadlock, J. (2011). *Professional WordPress Plugin Development*. Wrox Press Ltd..
- Koskinen, T., Ihantola, P., & Karavirta, V. (2012, September). Quality of WordPress plug-ins: an overview of security and user ratings. In *Privacy, Security, Risk and Trust (PASSAT), 2012 International Conference on and 2012 International Confernece on Social Computing (SocialCom)* (pp. 834-837). IEEE.
- Gravity Forms Tutorials. Retrieved from https://wordpress.org/plugins/gravity-forms-addons/

Appendices

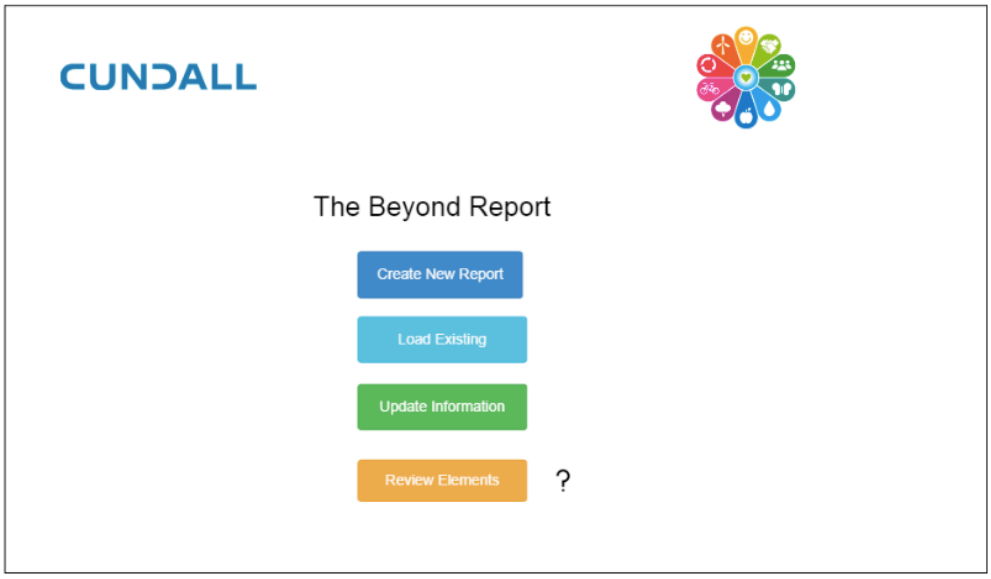
Conceptual Data Model

This model shows…



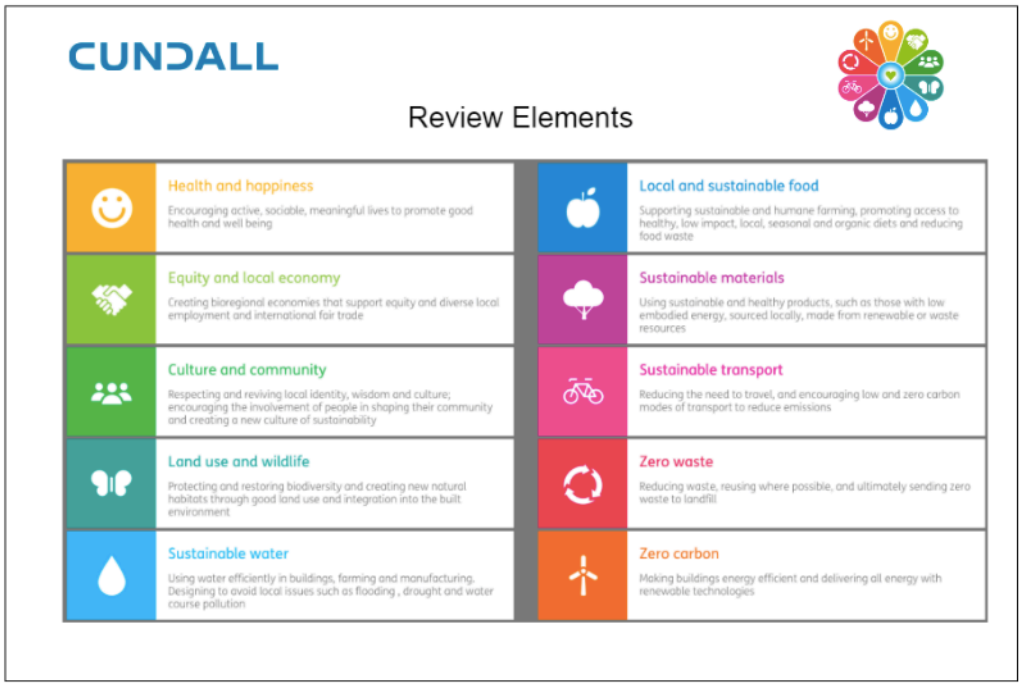
Initial User Interface Designs

These mockups show what the initial design of the user interface was and what the client agreed on.



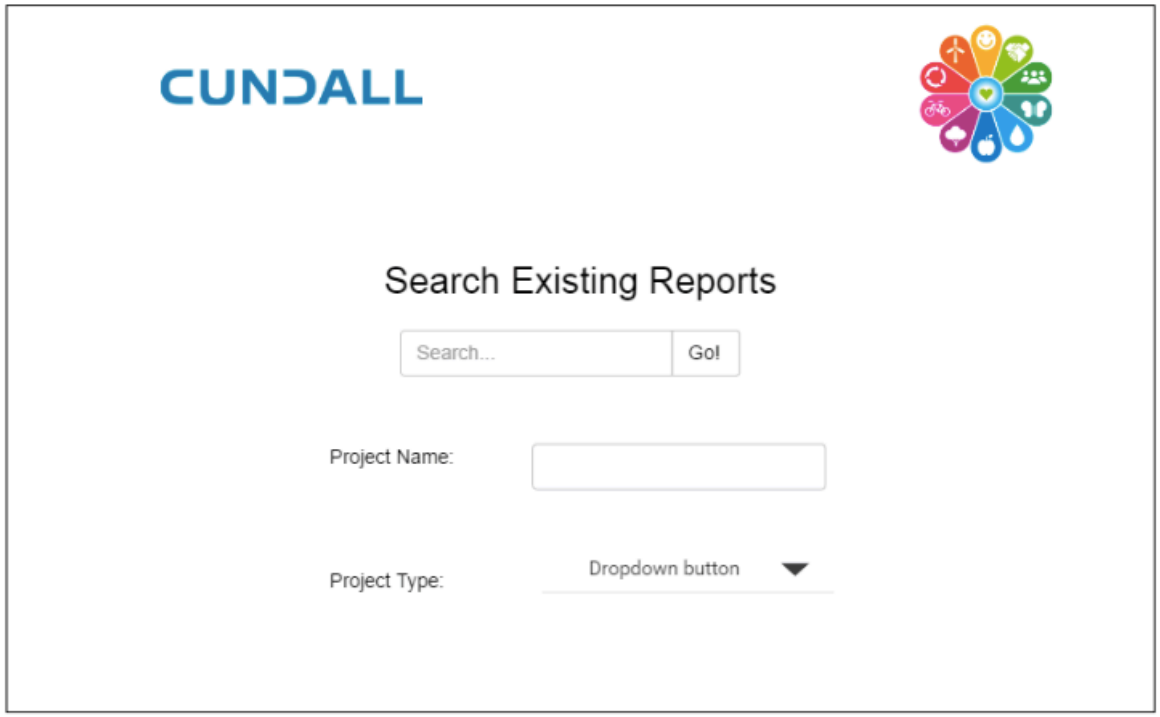
Home Page

Landing Page



Review Elements

New Report



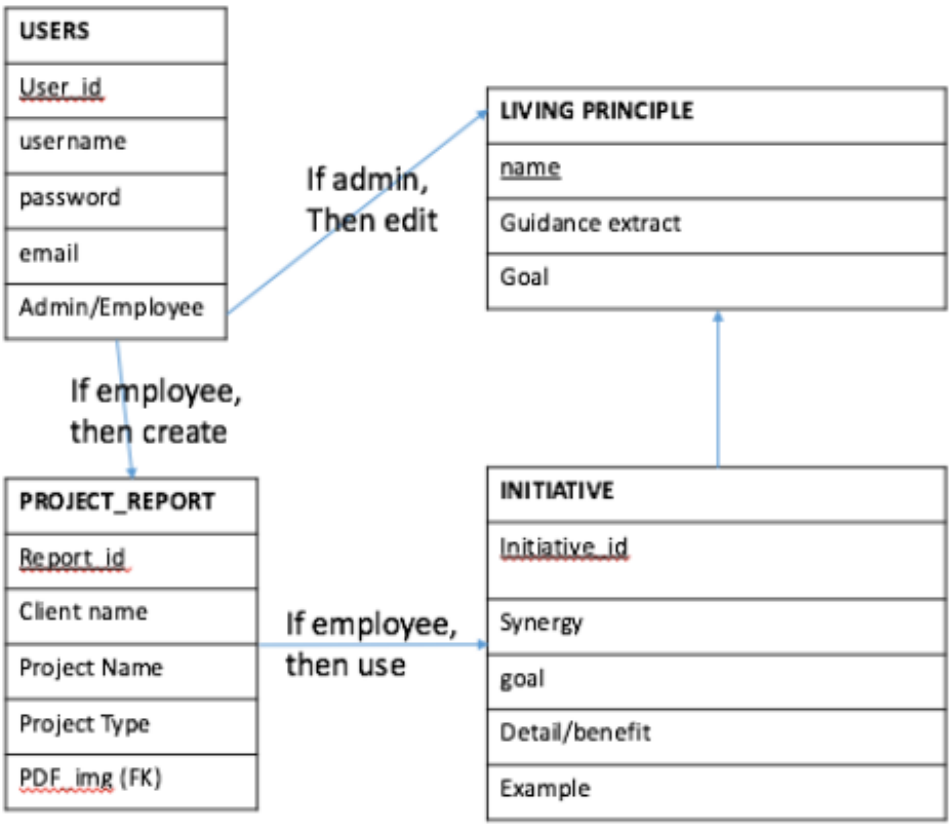
Search Existing Reports

List of Requirements (as mentioned in Table 1 & 2):

- Admin and Regular Users able to authenticate the application
- These users able to login
- Users able to choose pre-defined recommendations in the form
- Able to generate reports
- Export the report as a pdf
- Fields should be autocompleted
- Admin allowed to edit and create new data
- Deployed on any laptop operating system
- Deployed on any mobile device
- Easily maintainable by Cundall employees

Logical Data Model in 3NF

This model shows…



Project Plan

Beyond Report Project Plan

WBS	Task	Lead	Start	End	Cal. Days	% Done
1	**Team & Client Build-up**					
1.1	Team Formation	Prof. Chadi	Mon 1/16/17	Wed 1/18/17	3	100%
1.2	Client Research	Mohammed Zakaria	Thu 1/19/17	Sun 1/29/17	11	100%
1.3	Meeting with the client & project briefing	Ali Jafar	Thu 1/26/17	Mon 1/30/17	5	100%
1.4	Project Requirement Document	Ali Jafar	Fri 1/27/17	Thu 2/02/17	7	100%
1.5	Project Solution Research	Muhsin Warfa	Fri 2/03/17	Sat 2/11/17	9	100%
1.6	Project Proposal Document	Ali Jafar	Tue 2/07/17	Mon 2/13/17	7	100%
1.7	Meeting with the client on feasibility	Mohammed Zakaria	Thu 2/09/17	Fri 2/10/17	2	100%
1.8	Project Plan	Mohammed Zakaria	Tue 2/14/17	Thu 2/16/17	3	100%
2	**Design & Prototype**					
2.1	Prototyping with wordpress and ruby on rails	Mohammed Zakaria	Thu 2/16/17	Wed 2/22/17	7	100%
2.2	Project Design Document	Ali Jafar	Mon 2/20/17	Thu 3/02/17	11	100%
2.2.1	Client Design Mockup	Mohammed Zakaria	Mon 2/20/17	Thu 2/23/17	4	100%
2.2.2	Developer Design Mockup	Mohammed Zakaria	Thu 2/23/17	Fri 2/24/17	2	100%
2.2.3	Design User Testing	Muhsin Warfa	Fri 2/24/17	Sun 2/26/17	3	100%
2.2.4	Finalizing Design Implementation	Mohammed Zakaria	Mon 2/27/17	Thu 3/02/17	4	100%
2.3	Demo 1 Prototyping	Mohammed Zakaria	Thu 3/02/17	Mon 3/20/17	19	100%
3	**Deployment & Testing**					
3.1	Test & Deployment Plan	Muhsin Warfa	Mon 3/13/17	Wed 3/15/17	3	100%
3.1.1	User Testing	Mohammed Zakaria	Mon 3/13/17	Mon 3/13/17	1	100%
3.1.2	Client Testing	Ali Jafar	Tue 3/14/17	Wed 3/15/17	2	100%
3.2	Version Control System	Ali Jafar	Tue 3/14/17	Wed 3/22/17	9	100%
3.3	Demo 2 Prototyping	Mohammed Zakaria	Wed 3/22/17	Mon 4/10/17	20	100%
3.3.1	Demo 2 User login	Muhsin Warfa	Wed 3/22/17	Sat 3/25/17	4	100%

3.3.2	Demo 2 table creation	Mohammed Zakaria	Fri 3/24/17	Mon 3/27/17	4	100%
3.3.3	Demo 2 ranking	Ali Jafar	Sun 3/26/17	Wed 3/29/17	4	100%
3.3.4	Demo 2 Integration	Mohammed Zakaria	Wed 3/29/17	Mon 4/10/17	13	100%
3.4	Project Sustainability Plan	Mohammed Zakaria	Mon 3/27/17	Mon 4/03/17	8	100%
4	**Final Deliverable**					
4.1	Project Final Deliverable	Mohammed Zakaria	Mon 4/03/17	Mon 4/24/17	22	100%
4.1.1	Project Design Demo 2	Mohammed Zakaria	Mon 4/03/17	Thu 4/06/17	4	100%
4.1.2	Project Revising Demo 2	Ali Jafar	Fri 4/07/17	Thu 4/13/17	7	100%
4.1.3	Project Deployment Demo 2	Mohammed Zakaria	Fri 4/14/17	Tue 4/18/17	5	100%
4.1.4	Project Integration	Mohammed Zakaria	Tue 4/18/17	Sun 4/23/17	6	100%
4.2	Project Final Report	Ali Jafar	Mon 4/03/17	Thu 4/20/17	18	100%
4.3	User Manual for Client	Muhsin Warfa	Sat 4/15/17	Mon 4/24/17	10	100%
4.4	Presentation Preperation	Mohammed Zakaria	Mon 4/24/17	Sat 4/29/17	6	100%