



UNIVERSITY *of the*
WESTERN CAPE

Data Visualizer for CommCare

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This thesis is presented as part of the requirements for the conferral of the degree:

Bsc Honours Computer Science

The University of the Western Cape
School of Computer Science

April 20, 2017

Declaration

I, Moegammad F. White, declare that this thesis submitted in partial fulfilment of the requirements for the conferral of the degree Bsc Honours Computer Science, from the University of the Western Cape, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

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April 20, 2017

Abstract

CommCare is a technology by Dimagi. It is an open source platform designed for front line workers globally to help with gathering and distributing information. Using it, anyone can build a mobile application to collect data and perform case management at little to no cost. CommCare has numerous built-in reports which allow users to track activity of the mobile workers and their data collection. However, it does not have a way to perform analysis of the collected data. We intend to develop an analytical tool for CommCare users in the form of a web application. The application would make use of CommCare application programming interfaces to retrieve data from forms and our application will manipulate the data to create a graph or graphs of the user's choice and perform some basic analytics with the data. CommCare applications are used by different users. However, according to the CommCare website the applications are used by mobile workers in rural areas as well. Therefore, we have to create the analytical tool such that users with no analytical background will be able to learn how to use the tool effectively and also gain useful knowledge on how to perform useful graph analytics on different data sets.

Acknowledgments

William D. Tucker.

Sheel Shah.

Glossary

API application program interface.

CommCare refers to the application used by frontline workers

CSS cascading style sheets.

HTML hypertext markup language.

JavaScript a scripting language that works with hml and css.

JSfiddle a online environment that allows programmers to test javascript, html and css code.

Json (JavaScript Object Notation) a data interchange format.

Jquery is a javascript library.

Mobenzi provides technology involved in research, data collection, logistics and community service delivery..

Python a high-level programming language.

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Chapter 1

Introduction

Dimagi is a software social enterprise that develops software to improve service delivery in underserved communities. Dimagi aims to improve service delivery in the health, agriculture and development sectors. Dimagi makes use of their software platform CommCare, which has supported projects and hundreds of partners including governmental ministries with improvements to their health care management and logistics in their clinics. The CommCare application is designed for specific use in each sector. However, all CommCare applications store its data on the CommCareHQ. CommCare applications are specifically designed for mobile users to collect data and store it in custom or template forms. An example of how CommCare can be implemented is to monitor and improve prenatal, natal and postnatal care and infant nutrition(see figure 1.1). The application allows a user to register a mother and capture information about the mother according to the fields in the form(see figures 1.2 and 1.3).[1]. Users view and analyze the data in the forms in a spreadsheet form, which can make it difficult to spot trends for a user who does not fair well with poring over spreadsheets or reports. A visualization tool will enhance the ability of the CommCare users to analyze the data collected and make it easier to spot trends and make educated decisions according to the analysis of the data set. The visualization tool will be a web based application making it easily accessible by all Commcare users.

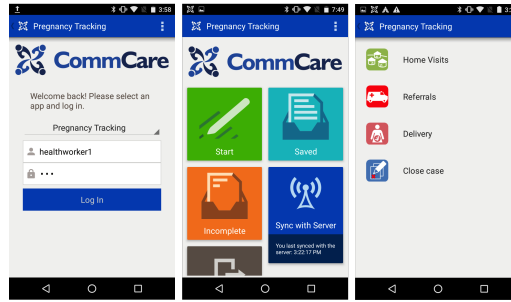


Figure 1.1: This is the basic layout of the CommCare application for pregnancy tracking.

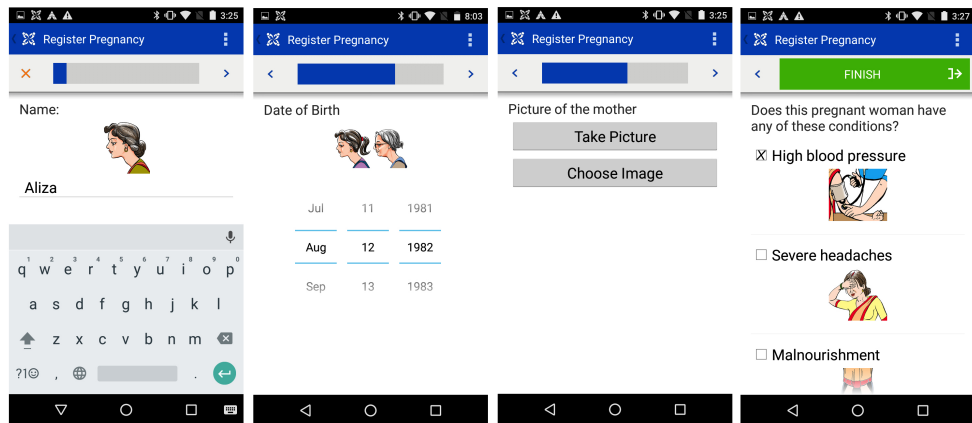


Figure 1.2: Here the registration of a mother is shown.

1.1 The Problem

It is difficult for the human brain to process spreadsheets and reports, to spot a trend in the data they are analyzing(see figure 1.4). The CommCare applications are predominantly used in under served communities, where education might be below average. Thus it could be that one of the community members is a mobile worker collecting data for their own research or work in a community. Visualizing data can help a mobile worker spot trends in the data which could lead to them making educated decisions to improve trends or spot whether the trend shows any damaging outcomes without any improvements.

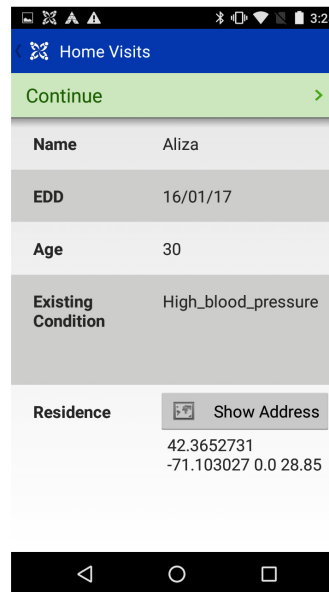


Figure 1.3: .

	A	B	C	D	E	F	G
1	User	Activistas > Registo e testagem	Activistas > Educaao > He	Activistas > Home vis	Activistas > Visit	All Forms	
2	supervisor	0	0	0	0	0	0
3	25-setembr	0	0	0	4	4	
4	upajo_01	0	0	2	4	6	
5	unidade_a_C	1	2	5	7	15	
6	niuhula_02	1	0	1	5	7	
7	napai_04	2	1	1	8	12	
8	napai_03	12	4	1	4	21	
9	napai_02	7	1	2	2	12	
10	napai_01	3	3	2	8	16	
11	nanere_01	2	0	1	2	5	
12	namahaca_0	9	4	4	7	24	
13	nacate_04	8	0	3	8	19	
14	nacate_03	3	0	3	3	9	
15	nacate_01	9	3	3	7	22	
16	mirige_03	2	2	2	1	7	
17	mirige_02	26	5	5	7	43	
18	mirige_01	8	0	3	3	14	
19	maviha_01	0	0	0	4	4	
20	matuto_04_C	0	0	0	4	4	
21	matuto_2_01	5	7	8	13	33	
22	matuto_1_01	0	1	3	5	9	
23	massingir_01	6	4	0	3	13	

Figure 1.4: A spreadsheet representation of the from data.

1.2 A Possible Solution

Dimagi has set out a specific solution: the deliverables the organization wants is an independent web application which retrieves data from the CommCare Head Quarters using the relevant API's and provides a web interface where users can perform data analysis and generate charts from their data. Dimagi specified that python would be the preferable back end language. However, the developer can decide which language would suit the problem best. The analysis types the application

should support are filtering forms by date, by questions, create different types of charts and all charts should be able to be modified by what the user would like the data to be presented like.

Chapter 2

User Requirements

A standalone web application must be created for users to visualize their data collected in forms. The application should be able to output the different type of charts and allow users to perform analysis of the data according to their requirements. The web-based application will have to support mobile devices as well. Making the application adjust to the screens desktop and mobile devices, we will develop the web application implementing a responsive design method. Responsive design refers to the use of hypertext markup language combined with cascading style sheet script, allowing websites to adapt to the size of a device's screen it is being launched on[2]. The design is important for a user who does not have immediate access to a desktop computer.

2.1 Software Solution Expectations

The application is aimed at CommCare users to perform basic analysis on their collected data. Users should be able to grasp the layout of the web application quickly and be able to perform necessary tasks with ease and understanding.

The web application should be structured around the following requirements:

- Users should be able to enter the name of their application and retrieve the database of forms.
- The application will accept the name of the application and use CommCare application API to retrieve the database for the user.
- The user must be able to select a specific form from the database and perform analysis on the selected form.

Examples of analysis the application should be able to perform:

- Filter the forms by a date range.
- Filtering the forms by the answer of one of the choice questions.
- Bar Graph - Selecting a choice question, then creating a bar chart with number of forms submitted with each answer (or percentage of forms) (see figure 2.1).
- Pie Chart - selecting a single choice question, then creating a pie chart with percentage of forms submitted with each answer(see figure 2.2).
- Line Graph- select a single choice question, then group the data by some period i.e. a month or week, then show percentage of forms submitted with each answer over time, thus there will be multiple lines on the chart(see figure 2.3).

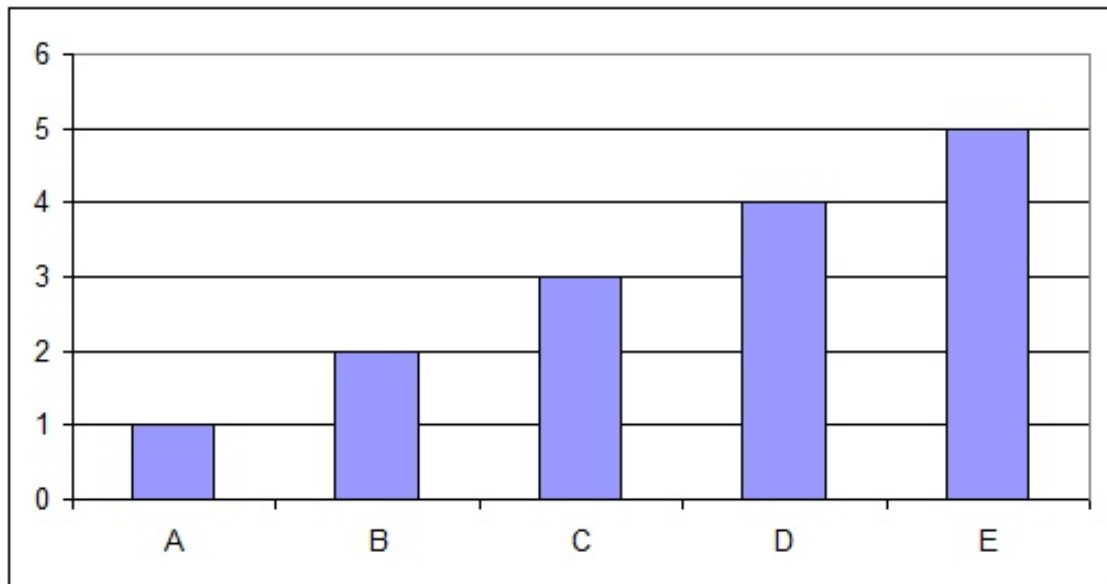


Figure 2.1: Example of a bar graph in the requirements.

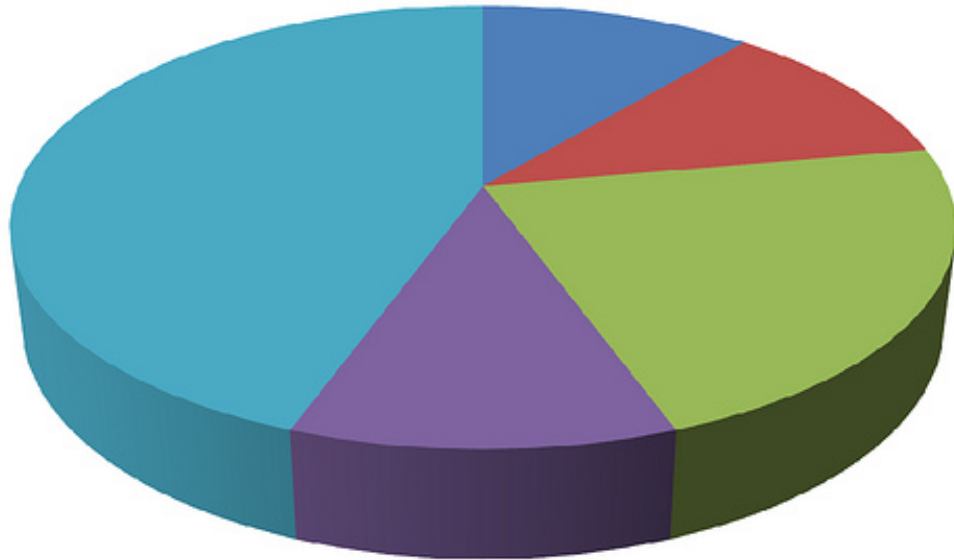


Figure 2.2: Example of a pie chart in the requirements.

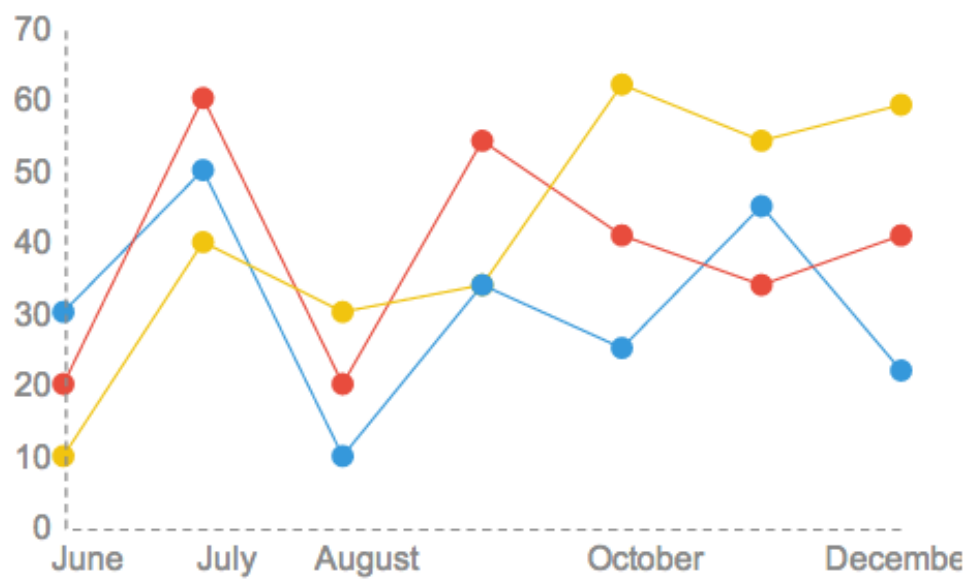


Figure 2.3: Example of a line graph in the requirements.

PLEASE NOTE: All graphs and charts will be updated with relevant information as soon as sample data is received and project implementation begins.

Chapter 3

Requirements Analysis

3.1 High Level View

The user will interact with the web application by entering their specific CommCare project name into the form API (see figure 3.1), which will display a list of forms from the user's application. The should then select a specific form to perform analysis on and generate a chart from the selected form data .A form's data is retrieved using the form data API (see figure 3.2). When using the APIs the visualization application will ask a user to input their project name which will replace the domain section in the list forms API and to input the form name that will be analyzed which will be stored in the form id section of the form data API which also requires the version of the CommCare application used.

```
list forms  
API-https://www.commcarehq.org  
/a/[domain]/api/v0.4/form/
```

Figure 3.1: The API used to retrieve the list of forms.

```
Get form data  
API:https://www.commcarehq.org  
/a/[domain]/api/[version]  
/form/[form_id]/
```

Figure 3.2: The API used to retrieve the data of a form.

The data, when retrieved is in Json format(see figure3.3).The JSon data will be manipulated using python and using python graphic modules the application will generate and visualize the data the user has selected.



Figure 3.3: The data retrieved in Json format.

The application will at first support basic visualization techniques as mentioned in chapter 3. The primary requirements in terms of charts are bar, line, histogram and pie charts for the user to select from or in some cases be allowed to select more than one graph to generate. As the development progresses and the application become increasingly reliable, more visualization techniques will be added. The application will allow a user to manually highlight specific trends, add more valid data to the currently displayed chart for comparing a variety of data.

The application will allow the user to perform different methods of analysis. A user will be able to group data by date range and be able to display data for a period of months or weeks where possible. The user will be able to filter through the data or select specific data to be displayed. The application will allow a user to export their charts by saving the chart in image format.

3.2 Related Work

The network data repository [3], is a web-based data analytics platform. The purpose of the platform is to allow users to analyze data in real time and identify trends which give them insight into the data set. Users are able to compare their data and export or share their data for external use.

There are a few web applications that support data visualization like Highcharts and flotcharts. Highcharts use javascript to process data and links to JSfiddle to design and create the graphs. Flotcharts is a JQuery based charting utility that allows a user generate simple line charts to more complex charts that are dynamic and can be customized with plot point symbols [4]. However, both of these tools are for desktop browsers.

Mobenzi similar to Dimagi developed software that acts as a service to under-served communities. Mobenzi has developed two applications, the Mobenzi Researcher application for mobile phones and the Mobenzi Researcher web console which is designed to support community-based health projects. The Researcher's web console supports the Researcher application similar to how CommCare's mobiles workers are supported by the CommCare Desktop website. A key difference is that the Mobenzi Researcher web console does chart visualization of the collected data. However, the charting is all web based and not scalable to mobile devices. The mobenzi technology is a paid for service whereas CommCare is completely open source and payments is only required when in need of CommCare development or technical assistance.[5]

Chapter 4

Project Planning

Table 4.1: Project Plan

Terms	Tasks
Term one	<ul style="list-style-type: none">-Research Web Application development articles and application examples.-Gather the user requirements from Dimagi representative.-Analyze the user requirements.
Term two	<ul style="list-style-type: none">-Obtain sample data from Dimagi representative.-Download all tools required for the development process.-Begin the design and construction of the prototype web application.-Create use case diagrams.-Create a storyboard.-User test the prototype and video record the testing.-Complete the documentation for term two.-Do term two's presentation
Term three	<ul style="list-style-type: none">-Improve the prototype.-Do more user testing.(video record)-Collect opinions from other programmers.-Improve prototype based on criticism.-Do some minor rework of documentation and add term three's findings.-Do term three's presentation.
Term four	<ul style="list-style-type: none">-Do final term usability test and add improvements gained from testing.-Make product efficient and reliable.-Make sure all back end code is well documented for external readers.-Create a user manual.-Write up final documentation.-Do final presentation

Bibliography

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- (2) F. X. Li, S. Z. Hai and L. J. Feng, “Responsive Web Design Based on Different-Sized Devices”, 2015.
- (3) R. Rossi and N. Ahmed, AAAI, 2015, vol. 15, pp. 4292–4293.
- (4) W. Bhany, *Create real-time graphs with these five free web-based apps*.
- (5) Mobenzi, *Mobenzi provides technology and professional services to organisations involved in research, data collection, logistics and community service delivery*.