BUILDING A DISTRIBUTED SYSTEM FOR COLLECTING HEALTH DATA USING MOBILE DEVICES

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Capstone project report submitted in partial fulfilment of the requirements

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New Delhi

Student's Declaration

I hereby declare that the work presented in the report entitled **"Building a Distributed System for Collecting Health Data using Mobile Devices"** submitted by me for the partial fulfilment of the requirements for the degree of Master of Technology in Computer Science & Engineering at Indraprastha Institute of Information Technology, Delhi, is an authentic record of my work carried out under the guidance of Prof. Pushpendra Singh. Due acknowledgments have been given in the report to all materials used. This work has not been submitted anywhere else for the reward of any other degree.

Date: 03/01/2016

Deepak Kumar Sood

Contents

Table of figures

Chapter 1
Introduction

1.1 Purpose

The purpose of this document is to describe the system that was used for large scale data collection using mobile devices that was researched as part of the Capstone Project undertaken in the final year of M.Tech at IIIT-Delhi.

1.2 Motivation

Data is the most important part for any research work in any field. But collecting data in a large scale from a wide variety of people that is geographically distributed and also culturally distributed has always been a challenge. Today mobile devices are becoming ubiquitous and has reached every corner of the world. Therefore we have used this mobile devices for collecting data from people using a novel approach called Open Data Kit that is a free and open-source set of tools which help organizations author, field, and manage mobile data collection solutions.

1.3 Definitions, Acronyms and Abbreviations

- ODK --- Open Data Kit
- GUI --- Graphical User Interface

1.4 References

1. https://opendatakit.org/
2. https://github.com/opendatakit
3. Open Data Kit: Tools to Build Information Services for Developing Regions Carl Hartung, Yaw Anokwa, Waylon Brunette, Adam Lerer, Clint Tseng, Gaetano Borriello In ICTD, 2010.
4. Open Data Kit 2.0: Expanding and Refining Information Services for Developing Regions Waylon Brunette, Mitchell Sundt, Nicola Dell, Rohit Chaudhri, Nathan Breit, Gaetano Borriello In HotMobile, 2013

Chapter 2
System Architecture Description

2.1 Overview of Components

2.1.1 ODK Build

ODK Build is used to build the data collection form for the survey. There are various technologies openly available for this purpose. Some are, ODK Build GUI Platform, XLS Form, Vellum, Kobo, Enketo, PurcForms or simple excel sheets can be used to create form and convert it to ODK Build format.

2.1.2 ODK Collect

ODK Collect renders forms into a sequence of input prompts that apply form logic, entry constraints, and repeating sub-structures. It collects the data from a mobile device and send it to the server.

2.1.3 ODK Aggregate

This component makes up for the server and provide functionalities like:

- provide blank forms to ODK Collect,
- accept finalized forms from ODK Collect and manage collected data,
- visualize the collected data using maps, simple graphs and other charts,
- export data,
- publish data to external systems.

2.2 Architecture and Relationships

The architecture and workflow of ODK is fairly easy to understand and visualize. It is depicted in figure 1.

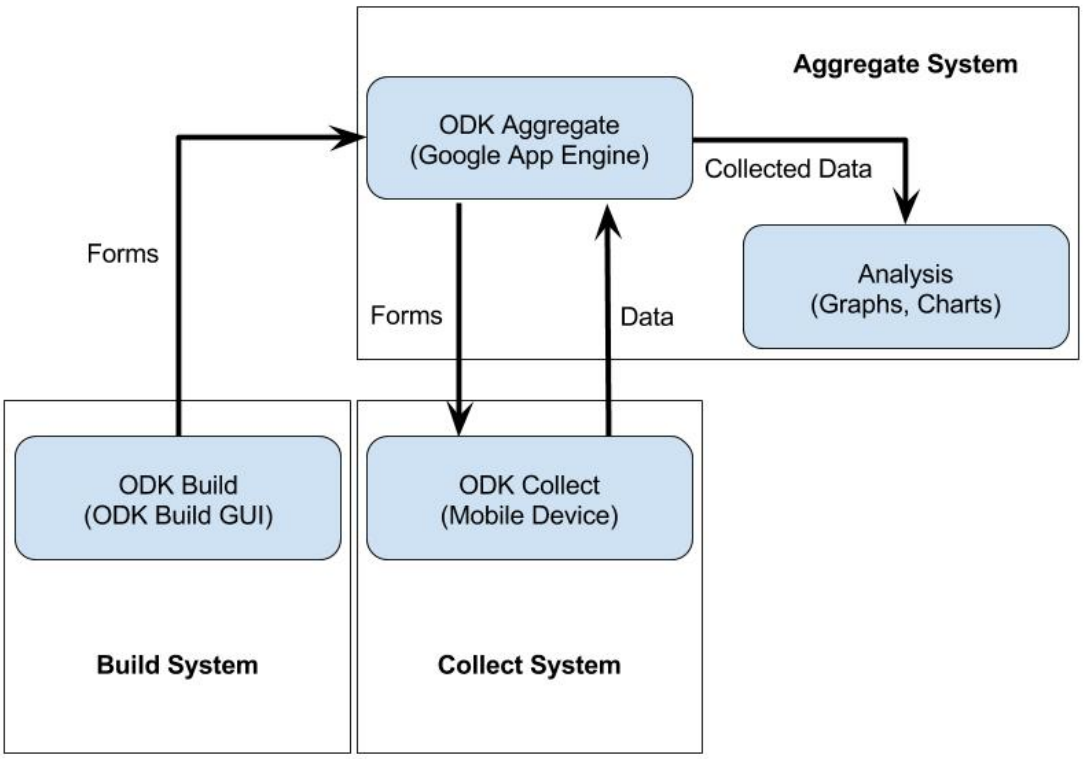

Figure 1 - ODK Architecture

The **Build System** sends the final form to the **Aggregate System** to store the forms. This form is collected by the **Collect System** to take the user entry and then the data is sent back to the **Aggregate System**. The **Aggregate System** is the final system to show the user data analytics in various forms.

Chapter 3
Detailed Component Description

3.1 ODK Build

Build is the process of making forms which can be designed in a number of ways according to the requirement and then converting it in a standard form which then can be uploaded to the server. We have used odk gui interface which provides a simple clean interface for making forms. It features a drag and drop feature where components of the form can be simply dragged and dropped in the order of the questions. The properties of every single question can be simply changed using the side menu with all the attributes.

3.1.1. Components present -

1. Text
2. Numeric
3. Date/Time
4. Time
5. Location
6. Media
7. Barcode
8. Choose One
9. Select Multiple
10. Metadata
11. Group

3.1.2. Attributes present -

1. Name
2. Label
3. Data Name
4. Default Value
5. Read Only
6. Required
7. Range

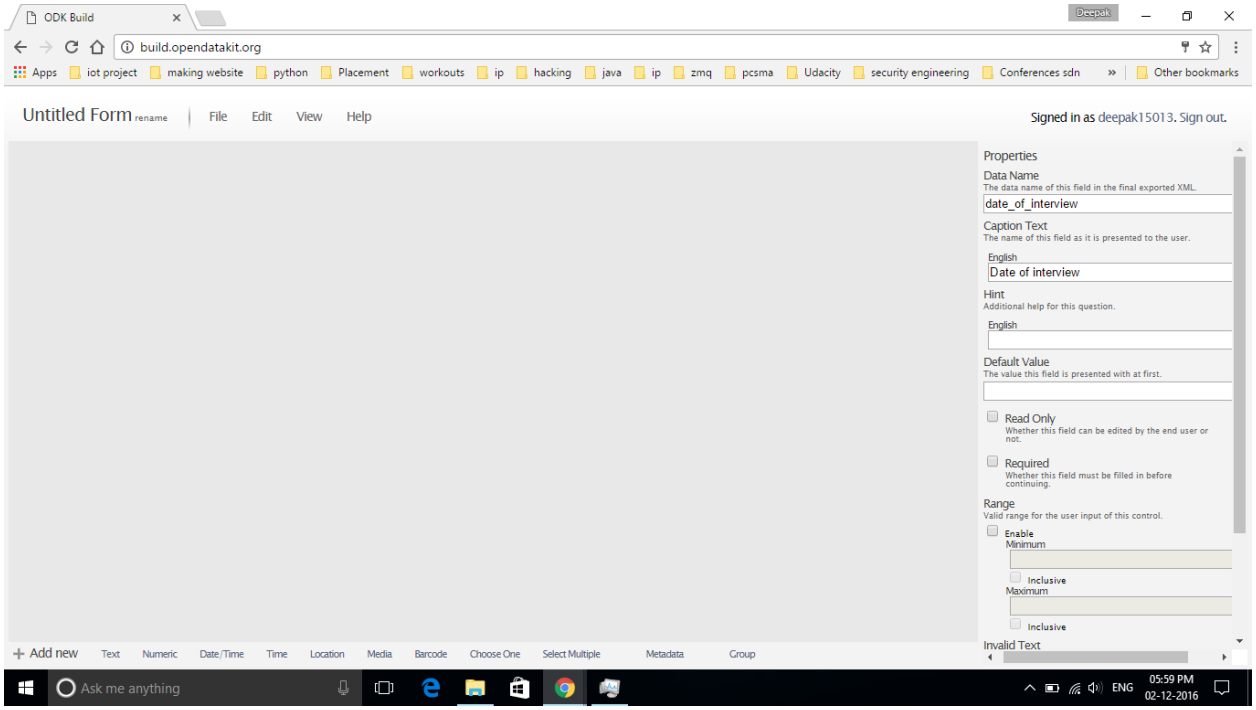

Figure 2 - ODK Build GUI Platform

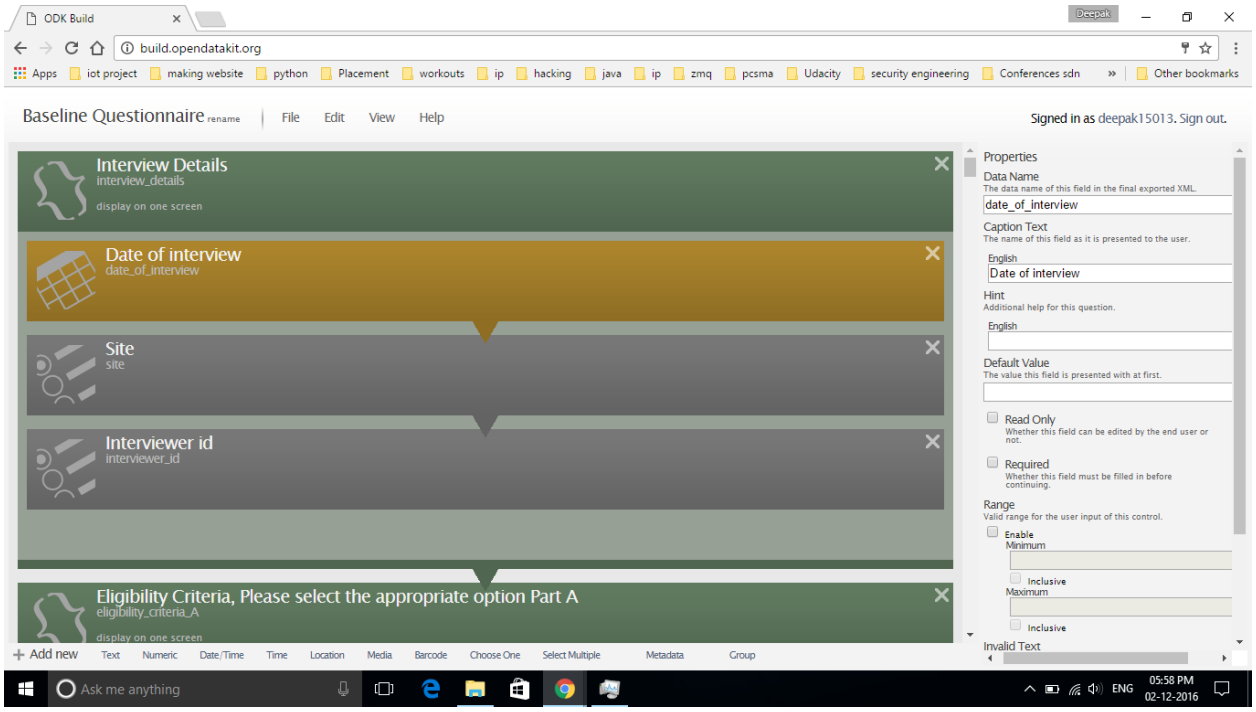

Figure 3 - ODK Build Components and Attributes

3.2 ODK Collect

This is the process of collecting the data. In this process mobile devices are used to get form from the server and then can be used offline to fill the data from the users any number of time. At last the collected data must be sent back to the server, where the analysis can be done.

Platforms -

1. Android - ODK Collect APK
2. IOS - Coming Soon (Porting to IOS)

3.2.1 ODK Collect Screenshots-

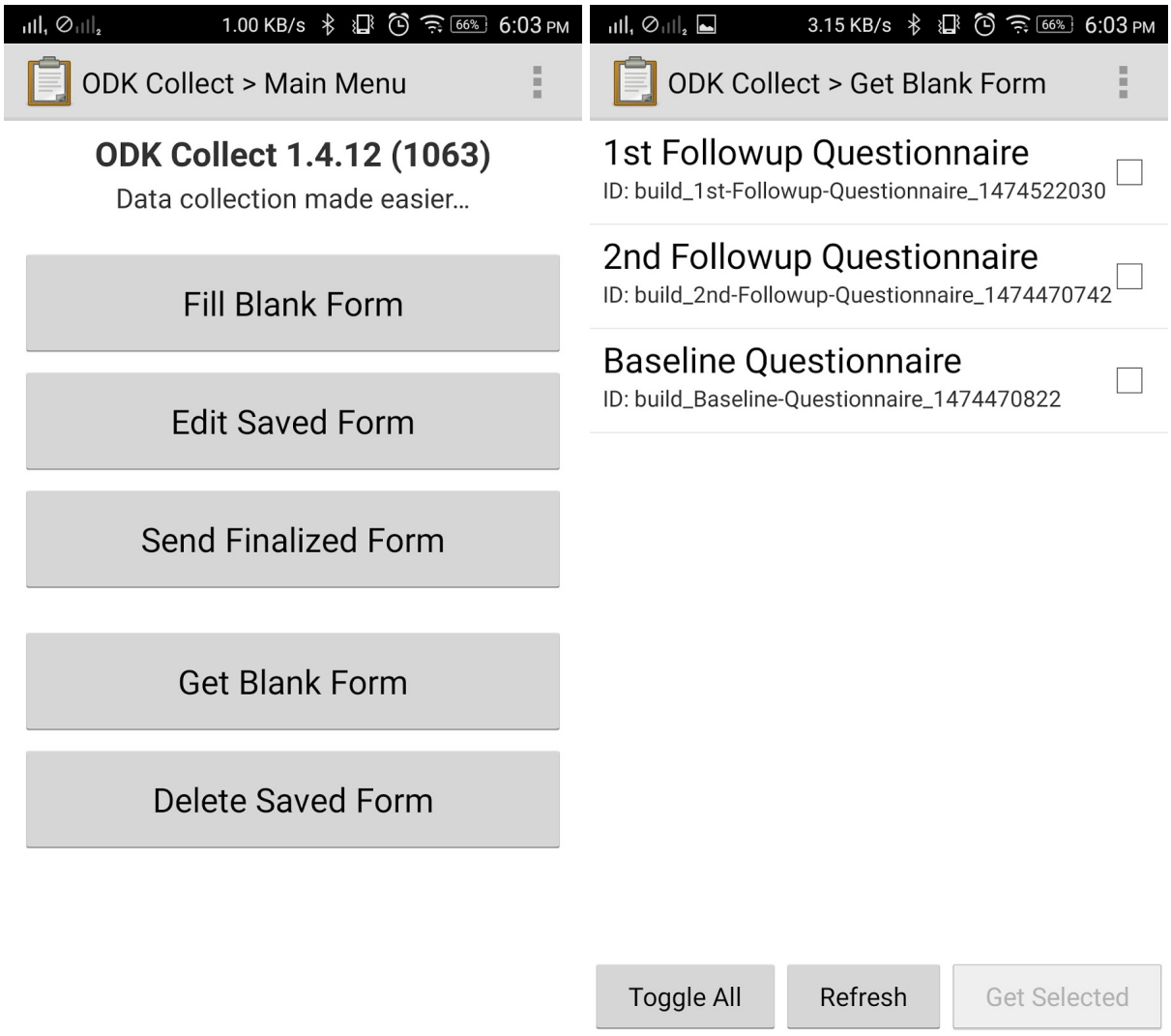

Figure 4 - ODK Collect Android Main Menu and Get Blank Form

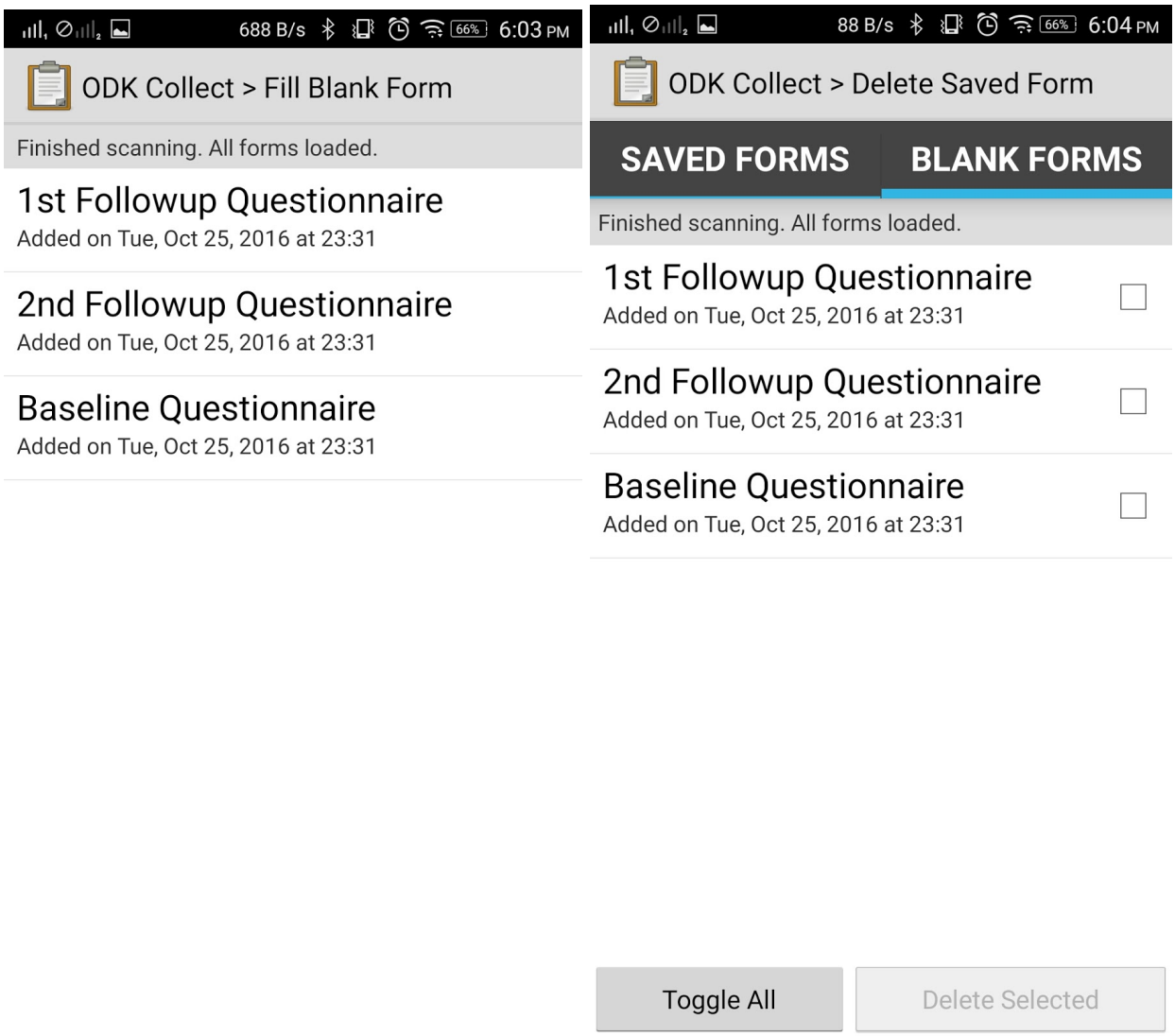

Figure 5 - ODK Collect Android Fill Blank Form and Delete Saved Form

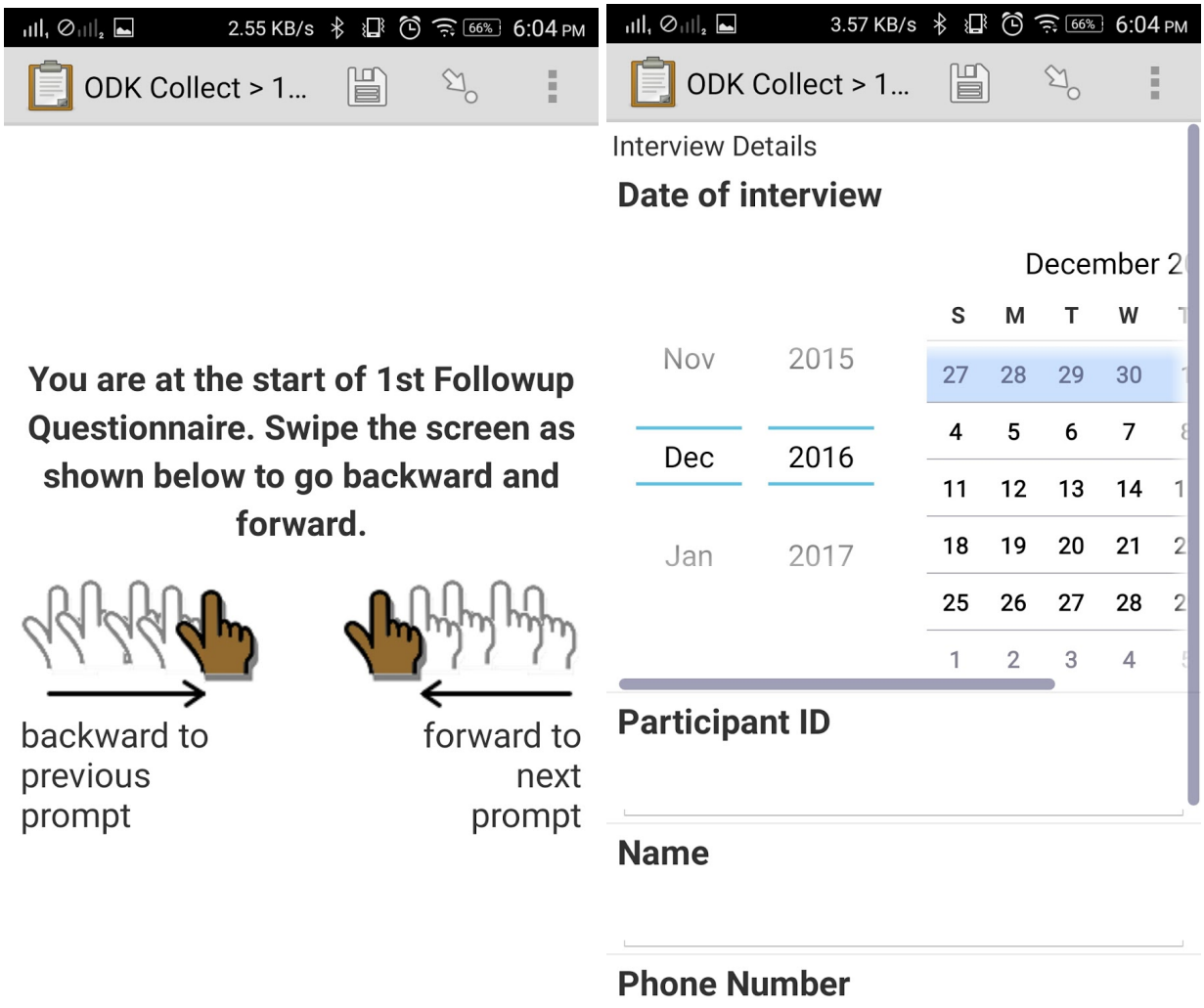

Figure 6 - ODK Collect Android Start Screen and Question Set

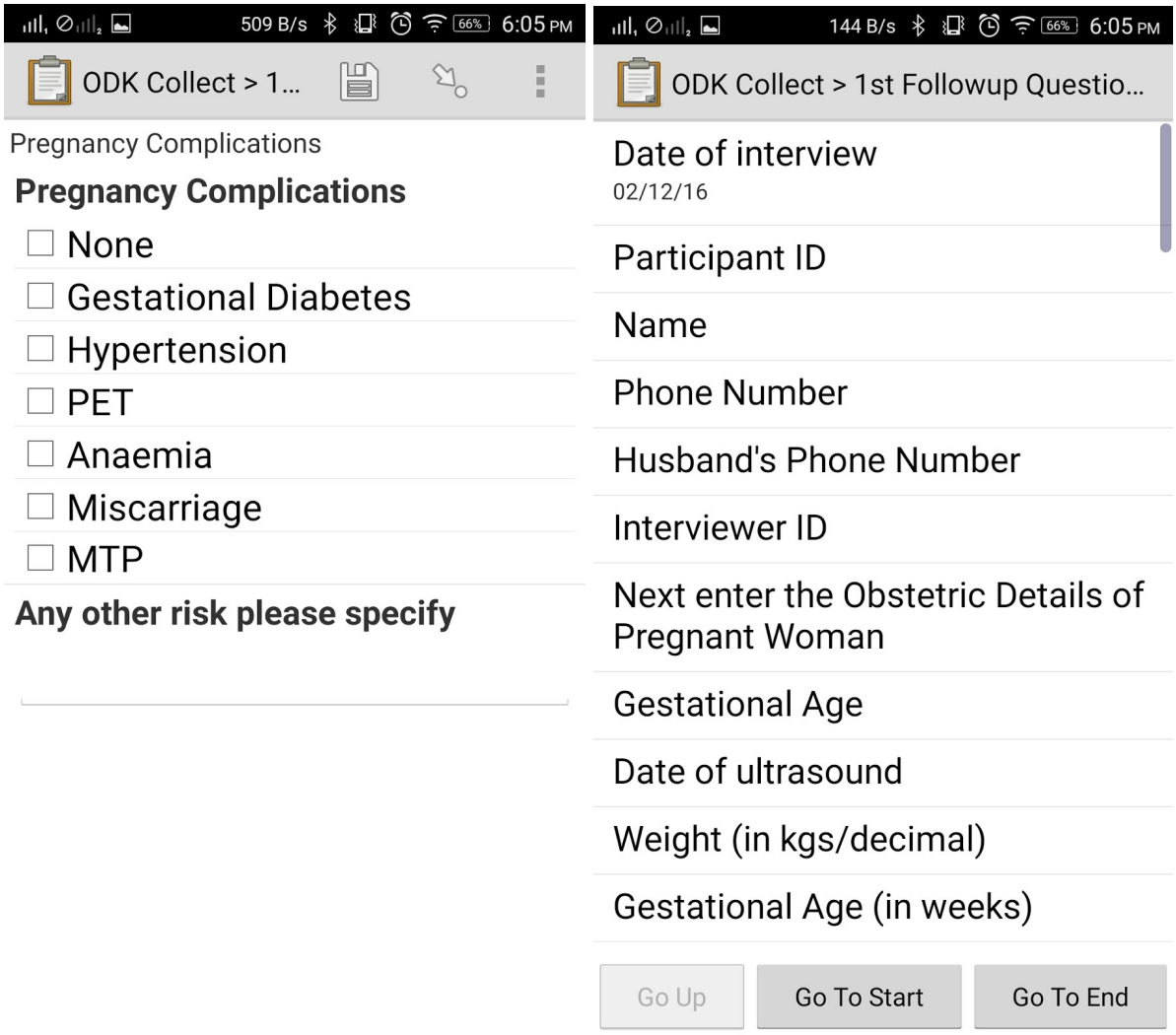

Figure 7 - ODK Collect Android Questionnaire

Figure 8 - ODK Collect Android Submitting Finalized Form

3.3 ODK Aggregate

ODK is being used to conduct socio-economic and health surveys with GPS locations and images, along with this ODK is being used to create decision support for clinicians and for building multimedia-rich nature mapping tools.

Components -

1. **Submissions -** All the data submitted by the user can be found here. The data can be visualized using different types of graphs, charts, etc. This data can be exported to different formats for further processing, storage or analysis.

2. **Form Management -** Add, delete, export or publish a form
    a. Forms List
    b. Published Data
    c. Submission Admin

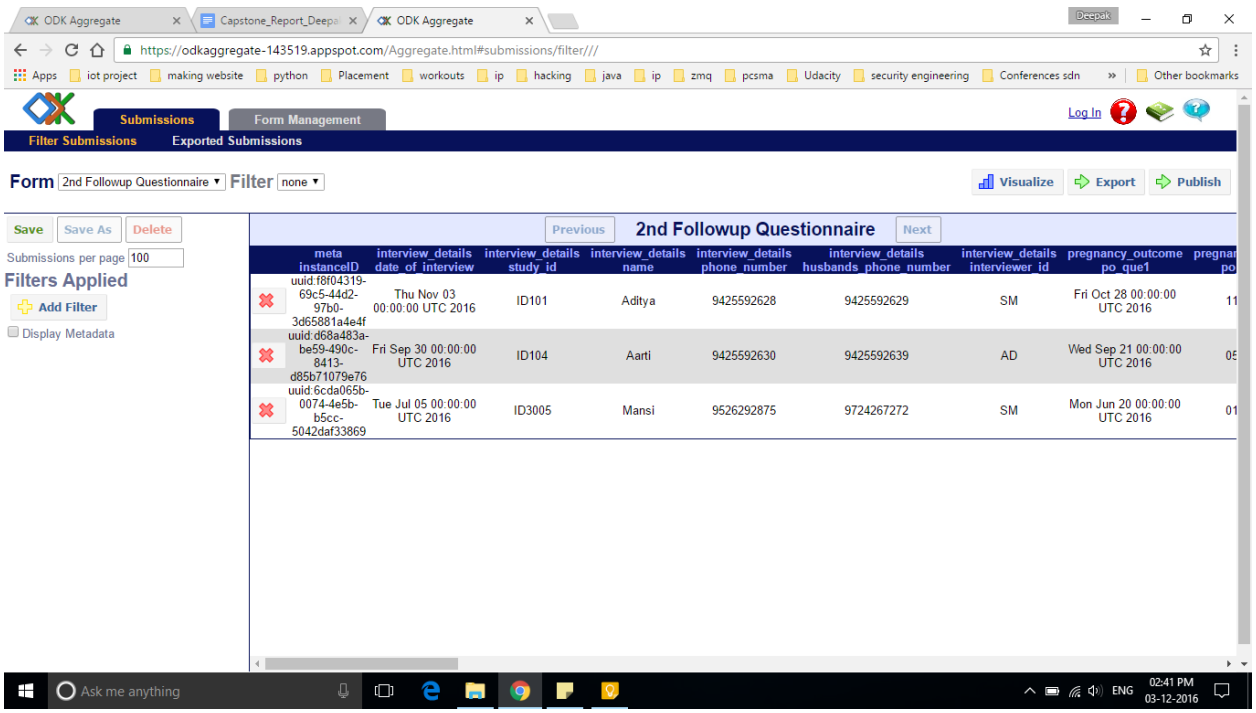

Figure 9 - ODK Aggregate Submissions Page

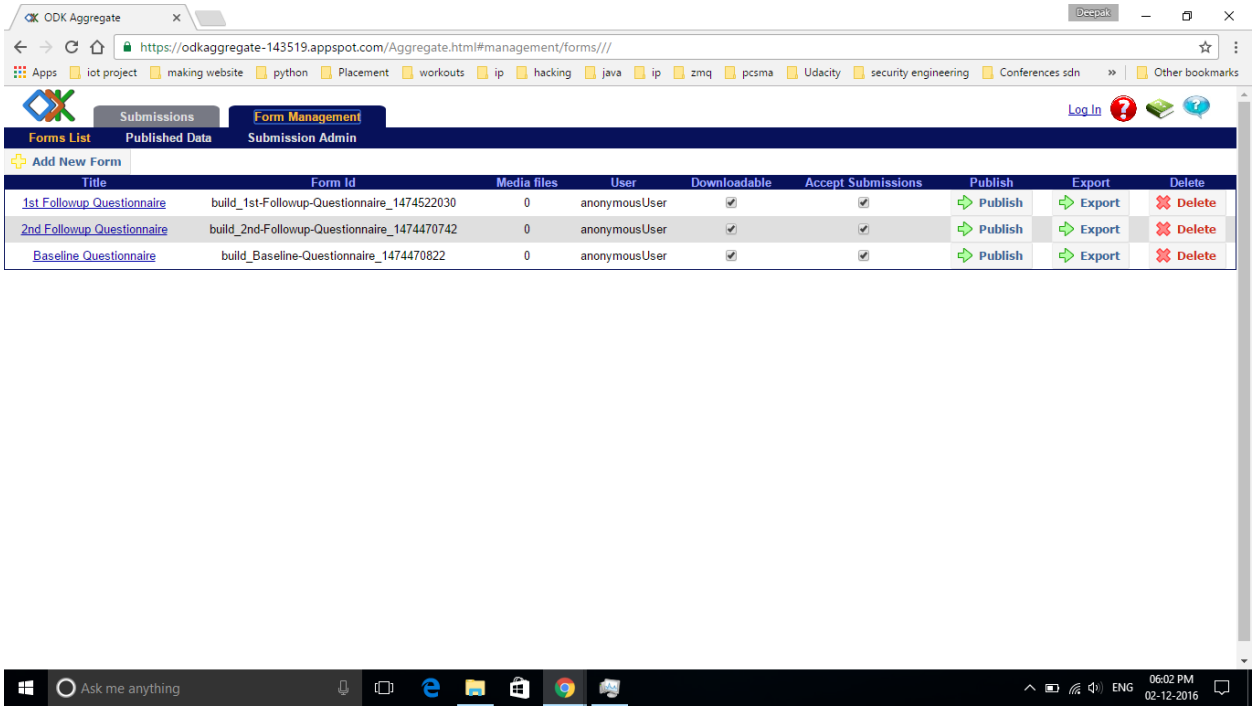

Figure 10 - ODK Aggregate Form Management Page

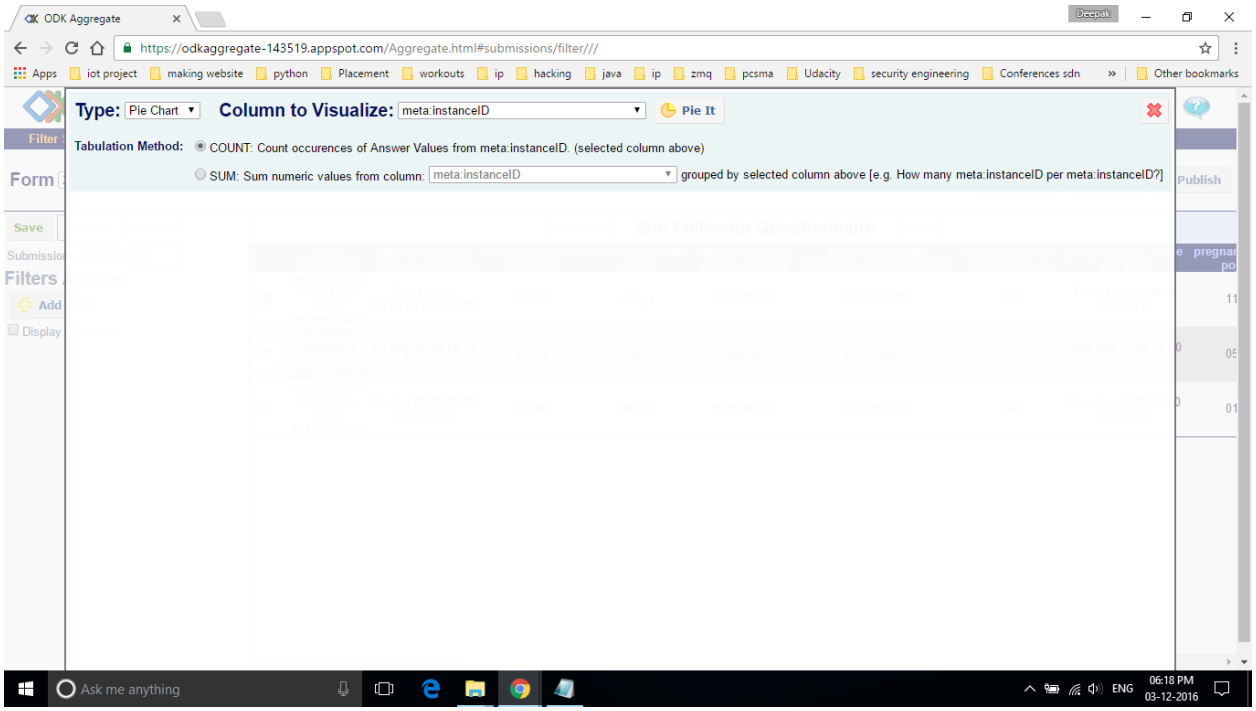

Figure 11 - ODK Aggregate Visualize Dashboard

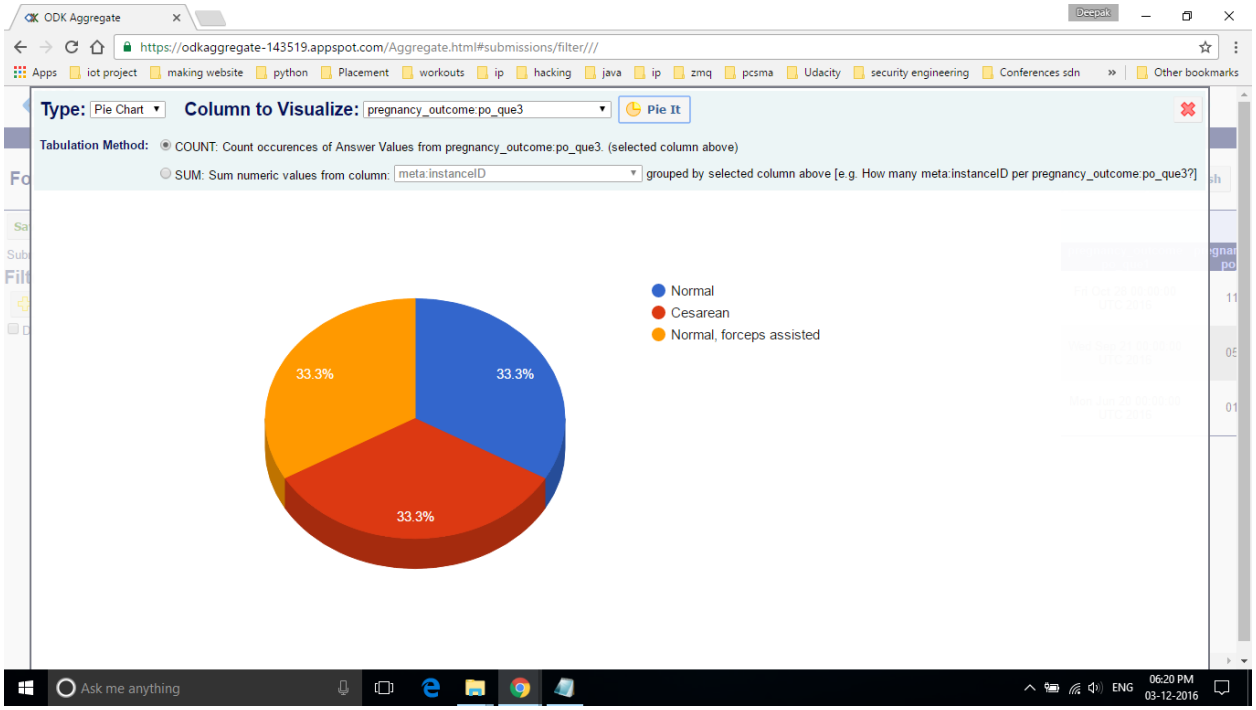

Figure 12 - ODK Aggregate Pie Chart Visualize Tool

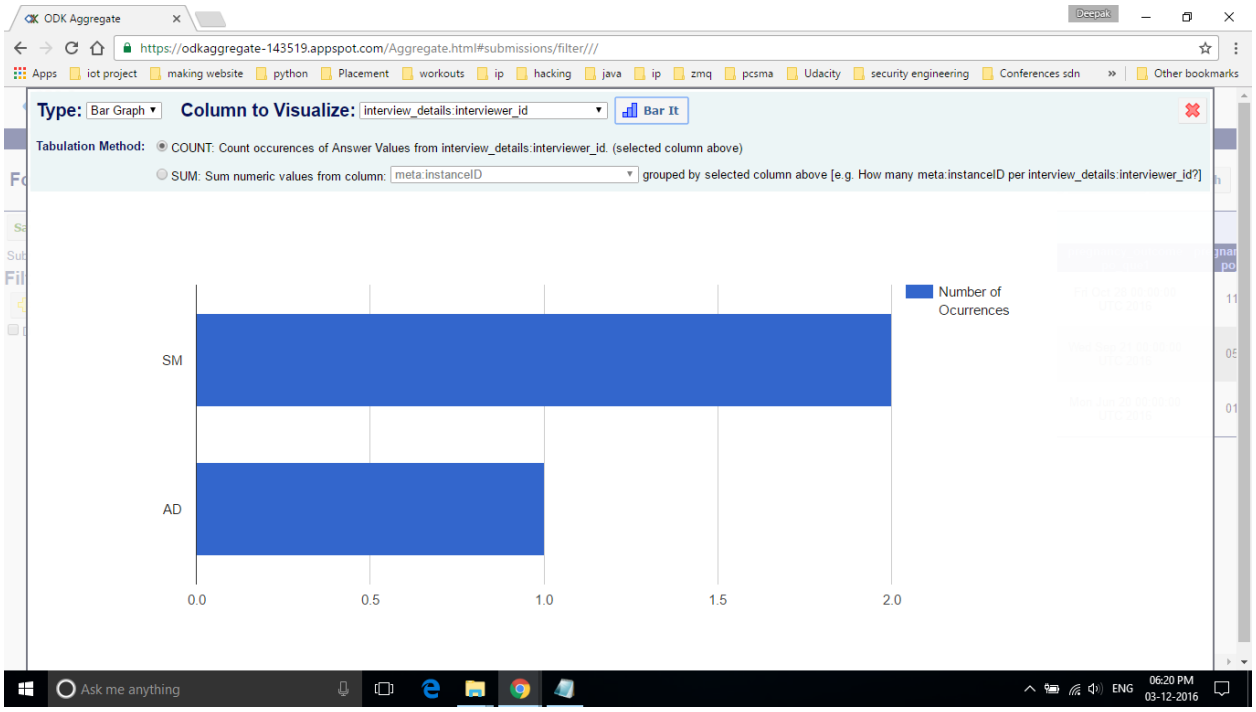

Figure 13 - ODK Aggregate Bar Chart Visualize Tool