AN APPLICATION TO CAPTURE SPATIAL DATA BY CROWD SOURCING

Durairajan V[1], Ragavee K[2], and Vimalathitthan S[3]

[1]Lead Developer, Arann Cybertek, Pallavaram, Chennai

Email ID: durai2404@gmail.com

[2]GIS Engineer, Trimble Information Technologies India Pvt. Ltd., Taramani, Chennai.

Email ID: ragavee_k@yahoo.com

[3]Project Associate, TERI University, 10 Vasant Kunj, New Delhi.

Email ID: vsv.voice@gmail.com

ABSTRACT: Over the past decade, crowdsourcing has emerged as a major problem-solving and data-gathering paradigm worldwide. The GPS which are currently available for data collection do not provide user defined attributes which lead to the development of many crowd sourcing mobile applications. These applications also have some limitations as they are developed only for certain specific themes which cannot be adapted for other themes. In-order to overcome this problem, applications can be developed which are adaptable for all themes. We have developed a user friendly Android based mobile application for data collection from users where the attributes are customizable by the user themselves. And data can be uploaded directly to the Geo-Database through web service. This data can be viewed in a map through Map Server and can be downloaded directly.

1. INTRODUCTION

Data collection is essential to do further research, analysis, and it is used for decision support system (Bertot, Jaeger, and Grimes, 2010; Hammon and Hippner, 2012; Stevens and D'Hondt, 2010). In Early times data was collected by taking direct readings and reliable resources. In this satellite and technology era, data collection is done through the digital media in rapid and quick manner (Mashhadi and Capra, 2011) . Crowd sourcing is a technology to collect data by multiple digital medium from both known and unknown resources (Bertot, Jaeger, and Grimes, 2010). The reason behind data collection from unknown resources is that it can be useful to us in some form, like during disaster (Gao, Barbier, and Goolsby, 2011), etc. One of the easiest way to collect data is by crowd sourcing using a mobile application (Chatzimilioudis et al., 2012; Stevens and D'Hondt, 2010). There are several applications available in the market to use this technology (Whitla, 2009). Here, we are introducing a user editable questioner based android application. In which the user can define what attributes should be used and its datatypes, along with the location information and a photograph. For any research activity the super user can monitor the data collection through the administrator rights from the office server and the user has full rights to create a new activity through the mobile device as well as the server. Regular data update to the system is useful to monitor the data collection part with the help of location based information and makes the data highly reliable.

2. SYSTEM ARCHITECHTURE

Figure. 1 represent the architecture of the entire system. The system uses SQL 2008 R2 Database and ASP.Net for the server side application and SQL Lite and Android is used for mobile application. The administrator has the authority to create the fields and define the attribute's data type. The user has to collect data using the user module such as mobile phone. After the data is collected it can stored immediately to the server, or in case if there is any network problem/remote area they can upload it later. The location information such as latitude, longitude and altitude are retrieved through the GPS and AGPS technology in-built in the smart phone. In this GPS service the number of visible satellites and the number of satellites used for obtaining that location information has been shown in this application. For better location information we need a minimum of four or more satellites in connection with the mobile device.

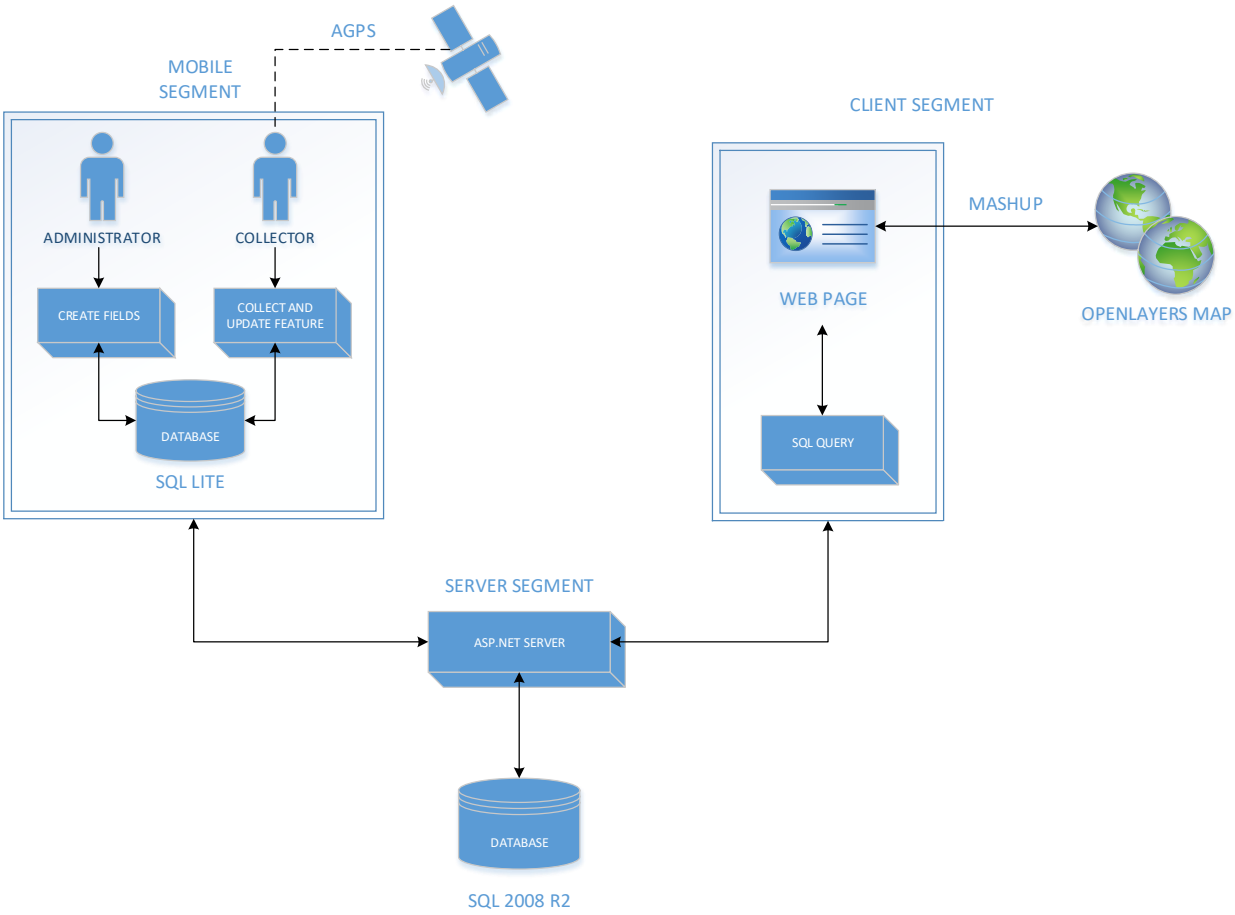


Figure 1. System Architecture

3. METHODOLOGY

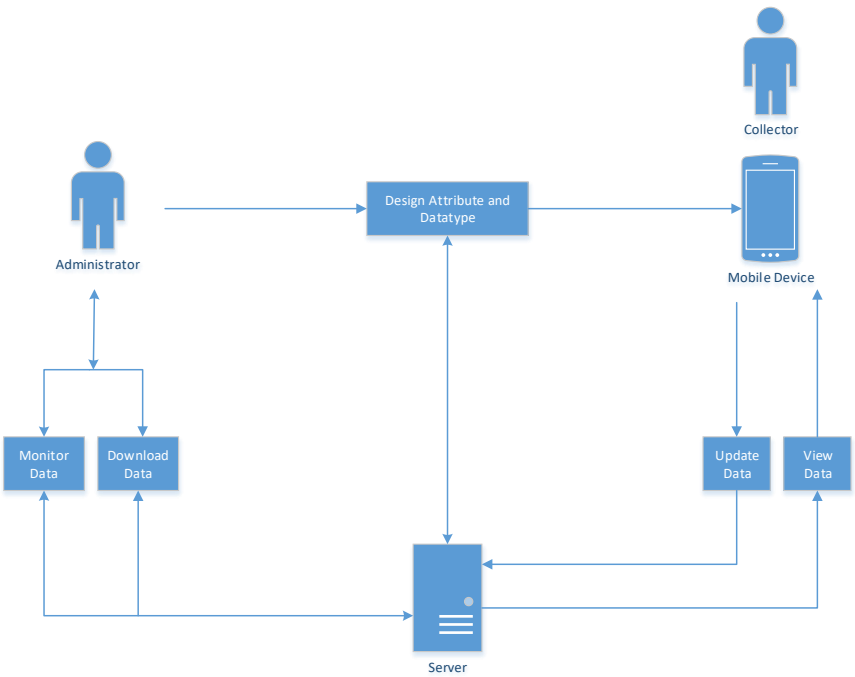


Figure 2. Proposed Methodology

The Administrator has to provide his login credentials to logon to the page where he can create, delete and update fields for the collector to capture data. The administrator can monitor the data being added to the database by the collector and download the same. The Collector can capture information such as latitude, longitude and altitude using the in-build A-GPS and GPS available in the Android mobile, and he can manually enter the values of the fields created by the administrator, along with which he can capture a picture of that location. After capturing the data, the collector can upload the data to the server and can also view the same.

3.1 Modules

Admin File Creation: This module is the main module in this paper, where the admin can create new files with his own attributes and data types. **Admin Login:** This module is a login module, where admin has to login for creating new files. This login is to restrict number of files being created unnecessarily, so only authorized people have permission to create files. **File creation with user defined attributes and data types**: This module consist of creating new files. In this module, Administrator can create his own file with his own required attributes and data types.

3.2 Collector file data collection

This module consist of data collection. Data collection can be done by anyone with this application installed in their mobile. **Data collection with location:** This module consist of getting geographical coordinates (latitude, longitude & altitude) using the inbuilt A-GPS available in Android mobiles. For Accuracy purpose, satellite details will also be displayed in right top corner, so data collector can know the details about the number of satellites available in range and accuracy. **Attribute entry**: This module consist of data entry. Collector will enter collected information in this application. **Photo from camera:** This module is used for capturing photos from camera in field. **Save the collected data:** Camera and save option will be enabled only when the application gets geographical coordinates from A-GPS.

3.3 View File

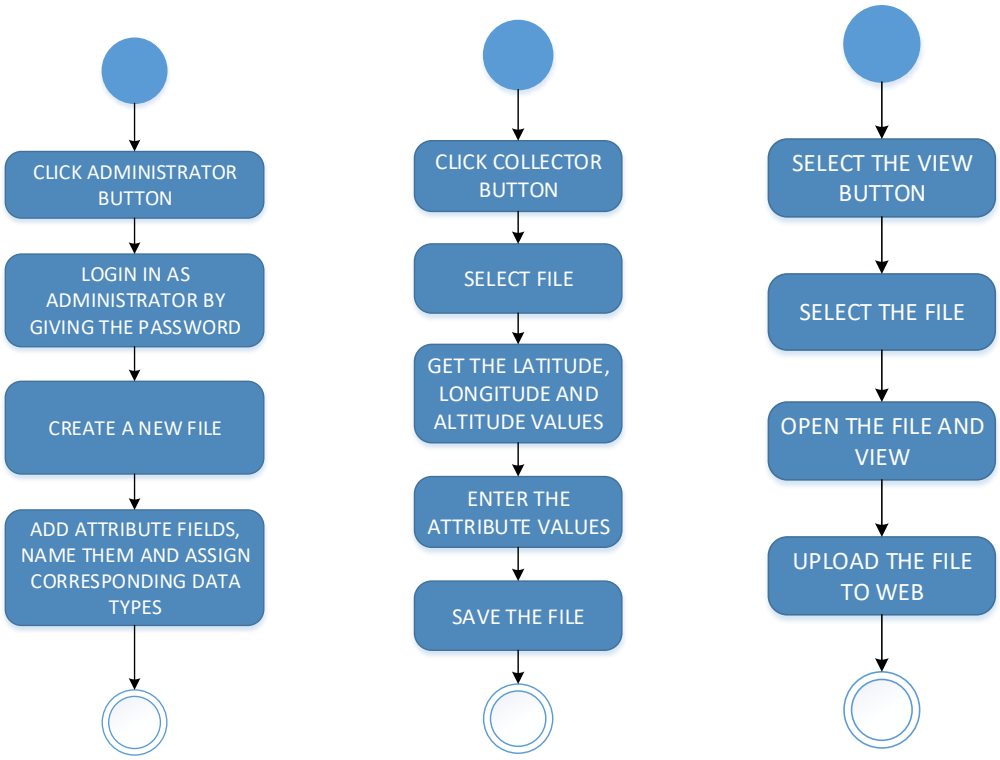
Select file and data for view: This module consist of viewing the collected data. Collector/Administrator will be able to select the file and view each collected data. **Share or update data:** This module consist of sharing or updating collected data. Collector/Administrator has an option to update the collected data and also share the same.

3.4 Download File

Download selected file in either kml or json or excel format: This module consist of downloading the collected data as s file. We can download the files in three formats such as, .xls, .kml or .json. As these are universal formats they can be easily uploaded and spatial or statistical analysis can be performed with any of the geospatial or statistical softwares available. **Web service:** Web service module consist of interconnecting both Application side and Server side. SOAP (Simple Object Access Protocol) and XML has been used to connect the application and the server.

3.5 Server Module

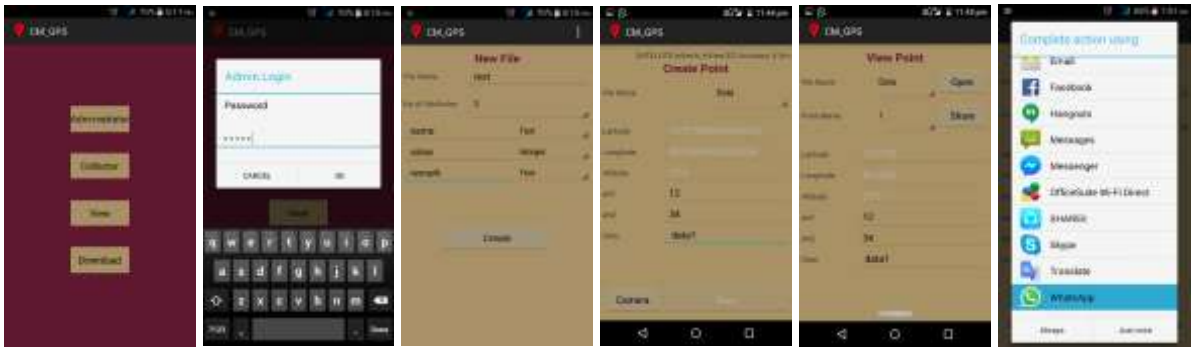
Web service Module: There are three ways we can consume a Web Service: (i) Using HTTP-POST method (ii) Using XML Http that will use SOAP to call our service (iii) Using WSDL generated proxy class. Web service has been created for transferring data from mobile to server. **OSM Module:** OSM Module consist of viewing of collected data using Open Street Map embedded in server. Mash-up Technique is used to embed the maps from OSM and collected data has been taken from SQL server database. **Geocoding Module:** Geocoding Module consist of geocoding of collected location details into geography type using SQL Server 2008 R2 database, so that the database can be added to any GIS software for further Spatial analysis.



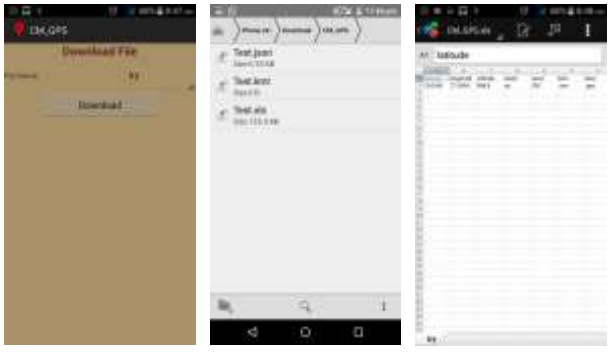
(a) Administrator **(b) Collector** **(c) View Point**

Figure 3. Activity Diagram

Result and Discussion



(a) **(b)** **(c)** **(d)** **(e)** **(f)**



(g) **(h)** **(i)**

Figure 4. User Interface

When the CM_GPS application is opened, the home page **Figure 4. (a)** is displayed which contains four buttons, **(i) Administrator** – Where a separate login is given to create and modify fields. **(ii) Collector** – Users can create point features. **(iii) View** – The points created by the users can be viewed. **(iv) Download** – The collected point features can be downloaded. **Figure 4. (b), (c)** The Admin can give his login credentials and has the privilege to create and update the required fields for the point feature. He can also view the point features collected by the users. **Figure 4. (d)** The Collector can create point features, by entering the required fields created by the admin. Latitude, longitude and altitude of the location is acquired with the help of the inbuilt AGPS and GPS in the Android Mobile. A photograph of the location can also be captured. **Figure 4. (e), (f)** the created point feature can be viewed and shared across different medium. **Figure 4. (g), (h) & (i)** All the point features which were collected can be viewed in the mobile, and downloaded in .kml or .json or .xls format.

CONCLUSION

This paper presents the necessary guidance for the mobile users who have installed this Android application. This application can be used for data collection from users where the attributes are customizable by the user themselves and data can be uploaded directly to the Geo-Database through web service. This data can be viewed in a map through Map Server and can be downloaded directly.

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