



# Implementation of Rainfall Record and Statistical Application for Android Platform

T. Venkat Narayana Rao<sup>#1</sup>, Jella Shruthi<sup>#2</sup>

<sup>1</sup>Professor, Computer Science and Engineering,

<sup>2</sup>Post Graduate Scholars, Computer Science and Engineering.

Sreenidhi Institute of Science and Technology, Ghatkesar, T.S, India.

**Abstract** - At present every sector in the government is moving towards mobile applications. Rainfall Statistics Android app is to collect day-to-day data about the rainfall conditions in the Telangana state and to cater to the needs of the directorate of economics and statistics as per the national standards of e-governance. This paper focuses on implementation of android app used for data recording, verifying and viewing tasks provided at different level of users (i.e. Mandal, Division and District). Data recording is done by Mandal level user. He can view reports and graphs related to Mandal. Division level user checks attendance and verifies data entered by Mandal user. District user can view rainfall entry and also view reports and graphs. Technologies used to develop this app are Java; Web services (RESTful) with the databases such as SQLite & PostgreSQL and tools used are NetBeans and Android studio.

**Keywords** - Android, java, PostgreSQL, SQLite, Web services.

## I. INTRODUCTION

In this modern era everyone prefers to possess a Smart Phone that has changed the definition of mobile phones, which led to development of different Mobile Operating Systems like iOS for iPhone and blackberry. Android for android mobiles developed by Google has emerged as a front runner in this generation. Since android can be implemented in a cheapest smart phone also, hence android is the most dominant operating system which is widely used across the world[1].

It is evident that android smart phones are more user friendly and is easy to carry than the traditional desktops and laptops. Hence, Government of Telangana has planned to distribute Android Tablets for Directorate of economics and statistics officers from the root level (mandal). Global Positioning Systems (GPS) is the technology which is used for locating a device position accurately. Rainfall Statistics app uses Location based services (through GPS) for tracking the location of an user. Additional hardware integration is needed in most of the mobile equipment as GPS receiver is used for Tracking. This application uses GPS as the approach idea for location tracking.

In an android system there is inbuilt database called SQLite database. SQLite is used for storing small data and constant data which is rarely changeable. PostgreSQL is an object-relational database management system (ORDBMS) and is a free software. The primary feature of Postgres as a database server is to store data securely, and data is retrieved when request is made along with username and password of database. In this app,

Postgres is used for handling large workloads with many concurrent users and is also used for storing large data.

Exposing the existing functionalities of the applications is bit tough as all the functionalities have to be re-written in the respective platforms. But it can be easily achieved with much ease by creating Web Service and expose the existing functionalities as web methods to Mobile platforms. Hence, in this application Restful web services are used to establish the connection between PostgreSQL server and Android platform[2].

## II. EXISTING LITERATURE

Many scholars had done preliminary research on android development are assessed in this paper. Few solutions are being proposed to address the challenges in android application development.

The anatomy of Android architecture contains Activity, Services, Content Providers and Broadcast Receivers which make the work easy. By these components application development become easy. The above anatomy is described in the manuscript which is proposed by Xianhua et al.

An article with entitled "Rainfall Monitoring System-counting rain drops", has given solution to root level rainfall stations to enter data on to the server and made this data available to generate reports and graphs. The above article is published by CVK Maruti Rao, district informatics officer, NIC, Orissa.

While developing a well used application, certain standards are to be followed. Hence, in order to incorporate such standards in this application, "Standards for e-governance", is proposed by Dr. Meenakshi Mahajan, technical director, NIC, is used.

The performance of web services in android devices is described by Amarpreet singh johal which has led to choice RESTful web services for this Android app[3].

## III. PROPOSED SOLUTION

Presently, rainfall monitoring is done through web based applications only which has lot of drawbacks. By considering the drawbacks of web based applications like lack of infrastructure & time consumption, Android app is a better solution.

Proposed solution is to build an android application for catering the needs of DES officials from the root level as it is user friendly, easy to collect and compile the data at any place. This system can also get attendance and presence of user in particular location using GPS[4][5].

**A. Architecture**

The Figure 1 and 2 shows a complete architecture of processes involved in the application. User interacts with android application for performing different tasks. For execution of tasks, an app hits the server using restful web services or uses SQLite database. During the submission of collected data through app, it checks the GPS location and compares it with the stored location to successful submission.

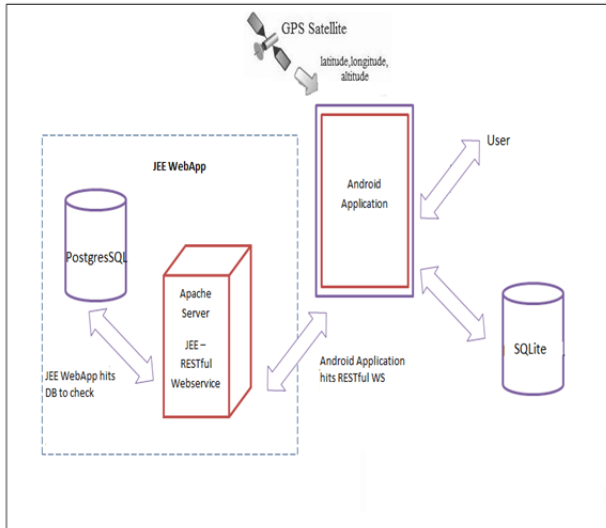


Fig. 1 Architecture of Application

**B. Design**

Designer model is designed to describe the overall structure of the project. Fig. 2 is the application flow design which describes in detail and used as reference modal for implementation of application.

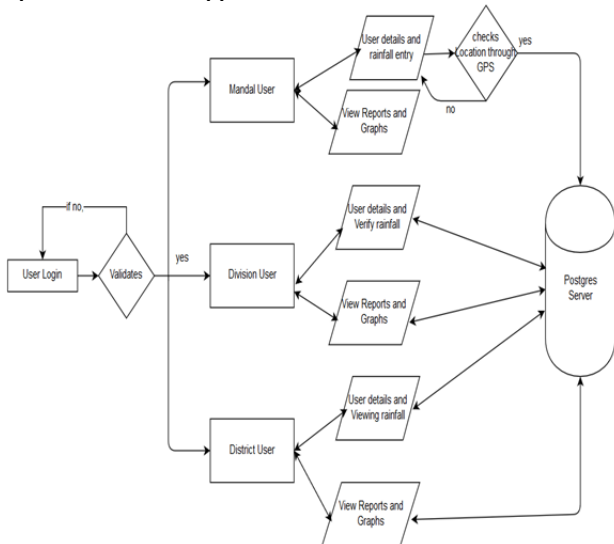


Fig. 2 Application flow

Only authenticated users can perform their respective activities. Depending on the user login details, they are navigated to the respective activities. Activities are connected to Postgres server for retrieving and storing the data[6].

**IV. IMPLEMENTATION**

In this section, implementation of the android app is explained by dividing into requirements, permissions and functionalities of modules.

**A. Requirements and Permissions**

The following are requirements and permissions needed for development of an application.

**1) Server Connection**

Android application is connected to the server by RESTful web services. In this application, AsyncHttp request and response is used. Data is transferred as JSON objects and arrays. For accessing the functionalities of Async Http the following dependency is added or compiled.

```
'com.loopj.android:android-async_http:1.4.9'
```

And for connection the Internet permission is needed which is registered in Android Manifest file.

**<uses-permission**

```
android:name="android.permission.INTERNET" />
```

**2) Databases**

Two databases are used i.e. SQLite database at application end for storing the constant data and rarely changeable data and the other database is PostgreSQL, as server for complete data which is maintained by Data centre. PostgreSQL is connected to RESTful web service with the help of dependency jdbc jar file (postgresql-9.4-1206-jdbc4).

**3) Location and Network Services**

For getting the GPS location and network state we need to get permissions. These Permissions are used for location updates and network state that is registered in Android Manifest file[7].

**<uses-permission**

```
android:name="android.permission.ACCESS_FINE_LOCATION" />
```

**<uses-permission**

```
android:name="android.permission.ACCESS_COARSE_LOCATION" />
```

**<uses-permission**

```
android:name="android.permission.ACCESS_NETWORK_STATE" />
```

**<uses-permission**

```
android:name="android.permission.ACCESS_NETWORK_STATE" />
```

Location information is retrieved with the help of Location Manager System by invoking the command getSystemService (Context.LOCATIONSERVICE). Code for invocation is shown below:

```
lm = (LocationManager) getSystemService (Context.LOCATION_SERVICE);
```

```
locationListener = new MyLocationListener ();
```

```
lm.requestLocationUpdates (LocationManager.GPS_PROVIDER, 0, 0, locationListener);
```

#### 4) *Graph jar*

For developing graphs, we used GraphView as the dependent jar in this project. Compilation of '**com.jjoe64:graphview:4.1.0**' is done to access the functionalities of the graph view.

#### B. *Modules*

The following are the modules in the application which shows the complete functionalities of rainfall statistics android application.

##### 1) *Login*

Every user should login into application for accessing the functionalities. Depending on the login details (designation) of the user, directed to respective activities. Password is encrypted and compared with stored encrypted password which gives authentication to user. Encryption is done by using SHA-1 hash technique.

##### 2) *Mandal user*

Mandal user is the primary user of this application. Rainfall statistics application is designed for Directorate of economics and statistics officers. Mandal level officers collect the rainfall data from rain gauge station and submits it to server through this application. This submission of data should be done before 12:00pm if not data cannot be submitted by Mandal users. During the submission Application the system checks for the GPS location of user and compares it with stored location, if the user location ranges 5 miles of stored location data then it will be submitted. Following are activities in this module[8][9]:

- *Rainfall Entry*: In this activity, data collected from the rain gauge station is entered. GPS location is checked in this activity only.
- *User details*: All the details of user are stored.
- *View reports*:
  - i. *Day wise report* – Based on date particular Mandal data of selected Mandal is displayed.
  - ii. *Week wise report* – Particular Mandal data from selected date to week days are displayed and seasonal date to week last day data will be displayed. Seasonal date depends on selected date. If selected date is after June of that year, then June 1<sup>st</sup> of that year is seasonal date. If not, then seasonal date is June 1<sup>st</sup> of previous year.
  - iii. *Month report* – Particular Mandal data of selected month and year data will be displayed.
  - iv. *Status report* – This report gives the status of Mandal i.e. whether Mandal is in scanty, deficient, normal or excess.
- *View graphs*:
  - i. *Week graph* – Exhibits Line graph which compares the normal rainfall of that particular Mandal with actual rainfall of that week.
  - ii. *Month graph* – Exhibits Line graph which compares the normal rainfall of that particular Mandal with actual rainfall of that Month of the year.

##### 3) *Division User*

Following are the activities present in the division user module. The main function of division user is to monitor its mandal user activities and data.

- *User details*: In this activity all the user details are present.
- *Rainfall verification*: Division level officers can verify the data entered by the Mandal level users by selecting Mandal and date to be verified. If the values are not entered, then division officer may enter depending on information from phone call or SMS from that Mandal.
- *Check Attendance*: Checks the attendance of Mandal users on the present date.
- *View reports*:
  - i. *Day wise report* – Complete division data is displayed as sum of rainfall and gives the highest rainfall Mandal in that division. Also displays complete Mandals wise report of selected date.
  - ii. *Week wise report* – Division wise report from selected date to week days is presented and seasonal date to week last day data also will be displayed. Seasonal date depends on selected date. If selected date is after June of that year, then June 1<sup>st</sup> of that year is seasonal date. If not, then seasonal date is June 1<sup>st</sup> of previous year. Also displays complete Mandals wise report when clicked on division name.
  - iii. *Month report* – division wise report of selected month and year data will be displayed. Also displays complete Mandals wise report when clicked on division name.
  - iv. *Status report* – Generates reports on the status of complete division i.e. whether Division is in scanty, deficient, normal or excess. Also generates report of all mandals when clicked on division name.
- *View graphs*:
  - i. *Month graph* - Bar graph which shows the sum of normal rainfall in that month in the Mandals comparing with sum of actual rainfall in that month of Mandals in the division.
  - ii. *Year graph* - Bar graph which compares the sum of actual rainfall of selected year with previous year and with sum of normal rainfall of Mandals in division.
  - iii. *Status graph* - Bar graphs which shows the number of mandals which has status as no rain, scanty, deficient, normal, excess and number of mandals with no data in the division.

##### 4) *District User*

Following are the activities present in the district user module. The main function of district user is to view whether all the mandals has entered into the rainfall data.

- *User details*: In this activity all the user details are present.
- *View today's rainfall*: District level officers will only view the data of all respective mandals.

**V. RESULTS AND DISCUSSIONS**

The following are the outputs screens of the application which shows the exact work done by the application.

Application is used to enter the data collected by Mandal ASO. The application checks the time and location of the user before storing the data to server. Figure 3 shows the entry at the mandal level.

Application is used for verifying the data at the division level which includes selection of particular Mandal and date within range of 7 days. Figure 4 shows the verification of rainfall in division level.

Figure 3 Rainfall entry form

Figure 4 Rainfall verification form

Through application one can view the reports and graphs of different level users. Figure 5 shows the status report of division.

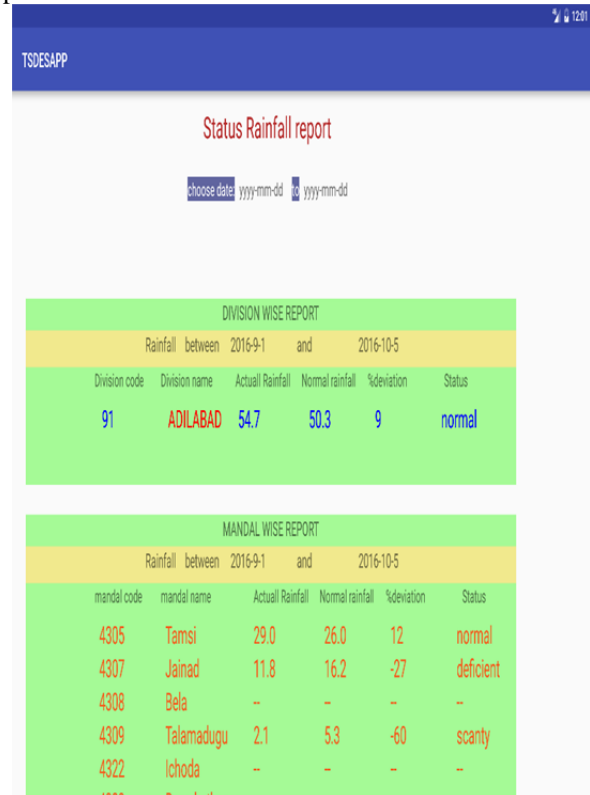


Figure 5 status report of division

Figure 6 shows the line graphs of mandal user. Figure 7 shows the status bar graph of division graph.

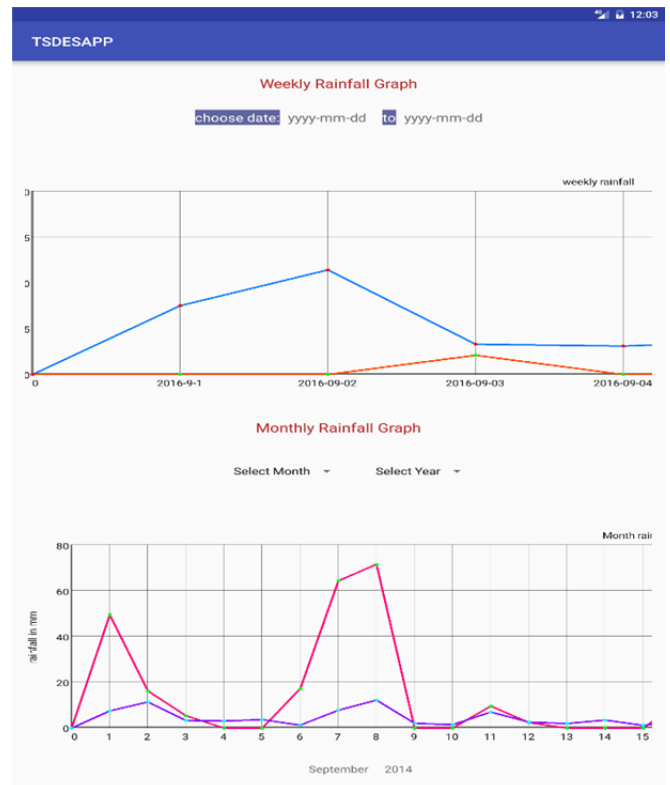


Figure 6 Mandal level graphs



Figure 7 status division graph

## VI. CONCLUSION

The directorate of economics and statistics of Telangana has indentured to offer their tasks through mobile devices across the state. Statistics of rainfall are used for maintaining the irrigation projects and for taking measures to help drought areas. So for accomplishing the activities, the department needs a fast, reliable and user friendly application. Thus, for catering the needs of DES officials, rainfall statistics android application is developed. By this application different level of users' needs are accomplished with much simplicity and reliability. Reports and graphs from this application help in various development activities in the state.

There would be areas with no internet facilities, so offline entry of data is added as future enhancement of the application. At present only viewing of reports and graphs can be performed, however, downloading of graphs and reports in pdf, word or excel format can be augmented as a future work.

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