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Design and Development of Cloud based interactive Dashboards to visualize the Real Time Rain Fall Meteorological parameters using Lightning Locker Service

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Article Info
Volume 83
Page Number: 8990 - 8993
Publication Issue:
March - April 2020

Article History
Article Received*: 24 July 2019*
Revised*: 12 September 2019*
Accepted*: 15 February 2020*
Publication*: 09 April 2020*

Abstract

Rain Measuring system (RMS) redefining the measuring and forecasting of rain fall information for farmers to stay connect to their agriculture fields and things they more care about. RMS enable the farmers to monitor and measure both infield and out field metrological parameters like wind speed,temperature,atmospheric pressure, humidity and more. Each RMS consists the rain gauge sensor will track the rain parameters and transmitted to the cloud data sets vis wireless medium. The data sets results can be view from any electronic devices like smartphone, laptop and pc and so on. Further measuring rain fall data sets privately share to the public to the weather communities.RMS having capability to visualize trend observations, real time metrological parameters changes and analyzing historical data sets for graphic charting. RMS analysis the precipitation of the rain fall, so that the farmers can easily know that how much amount of waters resources required for making land wet. MSintelligent alerts modulegets notified of changing conditions of the weather by email or test message using third part SMS/Email services.

To design and develop such intelligent forecastingsystems, we used advanced technologies and libraries like Salesforce Einstein analytics, Lightning, Lockerservice, Chart.JS,Forcetk.jscallouts for seamless visualization and maintain the state of the JSON (Java Script Object Notation) response of data sets generated. RMS used interactive .JS libraries, promising and outperformed in terms of the Quick render the data sets when compared with previous technologies.

I. INTRODUCTION

Climate science and Meteorology are the two key research areas committed towards the weather prediction not impacting the human survivable. The atmospheric science is a brad research are facing many research issues and some are Climate change prediction, air pollution, dynamics of wildfire, wind and mountain meteorology, tropical meteorology, wind and weather forecasting system and hydrometeorology. To address these issues effectively a new scalable architectural model is necessary to maintain data acquisition, storage and analysis of massive data is one of the interesting things. This paper discussed the legacy computing approaches for larger data sets limited to on premises.to extend the storage, processing and post processing activities, we proposed new cloud-based event processing paradigm to analyze the atmospheric information robust way.

The rain fall study is important to understand the water resource levels underground and useful to predict the high raining events for agriculture, drinking waters for humans. The two major periodic winds that are highly affected by rain are South West and North East monsoons. The Southwest Monsoon spreads from June to September across the State and from October to December the North East Monsoon (NE) spread over the State. In this paper

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we used the vertical rainfall profiles measured in the Kadapa semiarid tropical site of Andhra Pradesh (AP) with micro rain radar (MRR) (14,47 ° N; 78,82 ° F)India for the period from 2009 to 2018. Many authors are studied about rain meteorological parameters ad contributed the storage, processing and analytical approaches are supports on-premises applications and not suitable for modern larger scale forecasting applications.

Related work

The ground-based remote sensing devices based upon different physical parameters and operating at various electromagnetic spectral wavelengths are sensitive to the various atmospheric properties [1,2].The experimental &modelling activities are proposed by YVU with active support of ISRO to understand the monsoon, and also atmosphere processes/dynamics, more especially the precipitation thorough round the clock observations using remote and in-situ sensors [3]. The tropical raw data is in massive size and need big data kind technology required. The big data have high computing capabilities Like : Able to reads a wide variety of data from larger unstructured data sets, Reads data sets whose above the software tools limits, greater data management and analytics, adapt scaling approach for robust analytics[4].The processing system should relies on hypothesis based prediction, parallel algorithms and light weight integration approaches[5].The modern bigdata analytics usage and it's algorithms usage to process the atmospheric raw data well explained [6].The annual rain fall data is available from the Indian Government website for doing R&D at[7].The generated rainfall JSON data visualization will be forecasted with Java Script and Lightning Experience[8][9][10].

Experimental Setup & Test Bed

The complete research conducted at two experimental sites on YVU Campus Kadapa in Andhra Pradesh, India (14.47 ° N; 78.82 ° E). Experimental setup 1 occupied 3 acres of land, while experiment 2 conducted approximately 100 acres. We used observatory and simulation equipment from the Dept. of Physics, YVU campus for the Semi-Aryan Zonal Atmospheric Centre. The total experimental set-up and computing facilities presented in Fig.1, Fig.2 and Fig.3 below.

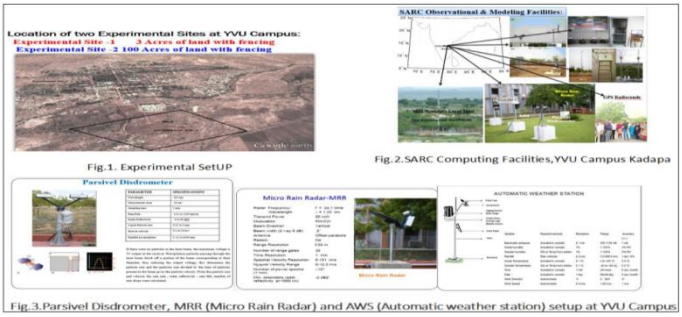

Fig.1. Experimental SetUP

Fig.2.SARC Computing Facilities,YVU Campus Kadapa

Fig.3.Parsivel Disdrometer, MRR (Micro Rain Radar) and AWS (Automatic weather station) setup at YVU Campus

Proposed Java Script Libraries for Data Visualization

In this paper we discussed about various interactive dash boards development for Rain fall data. Some of the Free visualization API's (Flot, Flotr2, jqPlot, etc.) and can do with commercial API's (am Charts, High charts, Fusion Charts, Charts JS, etc.). The new projects implementing d3.js (D3) and it has emerged as a de-facto data visualization standard. D3 javascriptapi is usually "lower" than other libraries, but other libraries like dimple, NVD3, xcharts and Rickshaw have also been installed in the top of D3. Out of Dimple id the higher-levellibrary used than D3. In this work we used D3 and Chart.js to build interactivedashboards to visualize the rainfall data.

Data Access Methodologies

The proposed solution discussed about various methods of retrieve real time data in interactivedashboards. The best way is Analytics API and REST API are more popular and widely adapted. The typical REST API enables the consumer client to directly access their data from normal or customized cloud environment(cloud object). The Data filtering and visualize the specific parts of key information is the programmer responsibility. Einstein by building one or several Sales force reports you implement the data selection logic (using the Point Click Report Builder) with the

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March - April 2020
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Analytics API. Analytics API to execute these previously prepared reports and get the rainfall data in JSON format in real time. The analytics API offers additional characteristics such as having a list of results, getting a report metadata, and the ability to synchronize or asynchronize reports.

In this paper we used REST API to get a list of rain fall events using SOQL, SAQL using Salesforce Lightning application events and Locker service.

Client-Side vs Server-Side Data Transformation

Various charts are available for different specific information and to be filtered, grouped, and aggregated by writing complex SOQL queries. The advantage of this interactive dashboard loads the real time data in regular snapshots and not interacts with server every time, so the application runtime is low and robust. We have implemented client-side application using JavaScript and Server-side programming using APEX. The data transmission between client and server as follows:

Choice 1:

Application received large volume of the rain fall data sets from the server (for example, all the rain fall events with larger reflectivity) and the application client filters, groups, and aggregates the rain data on the basis of different graphic specifications as the user interacts with the dashboard as needed. Limiting the number of rainfall drop sizes and the transformation of data at the client side will typically provide more user experience and will display more data.

Choice 2:

The application on client side makes network requests for data to be filtered and aggregated in real time based on certain requirements of the charts as the user interacts with the dashboard.. The server-side data filtering, grouping and aggregation is a more straightforward model, but the network latency involved in each request will make the dashboards less responsive.

The discussed above two choices are more specific and suitable based on the specific situation and implementation requirement. The combination of using these two choices are usually a good approach.

DATA ANALYSIS & RESULTS

The large volume of rain fall data is collected from various sources [2,7] and analyzed with developed application. The key metrological information is extracted and visualized in Dashboards. The implementation is more interactive and able to visualize the snapshots in PC, Tablet, Mobile and any Salesforce1 applications. The Fig.4.illustrate the rain fall rate is less than 0.5 and Fig.5. displays the information about the rain rate between 0.5 and 5mm h-1.Fig.6. illustrates the rain rate between 5 to 10 and Fig.7. presents the stratiform and Convective precipitations during the monsoon season.

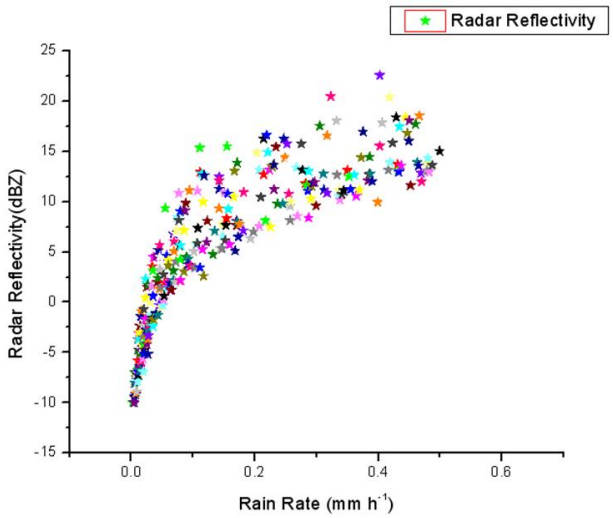

Fig.4.RainRate vs Radar Reflectivity

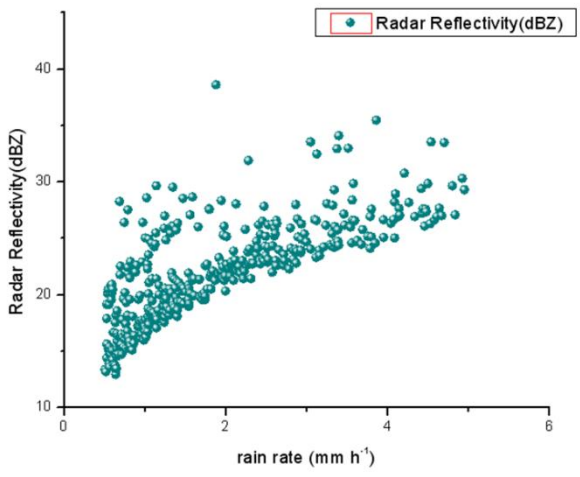

Fig.5.Rain Rate 0.5 < 5

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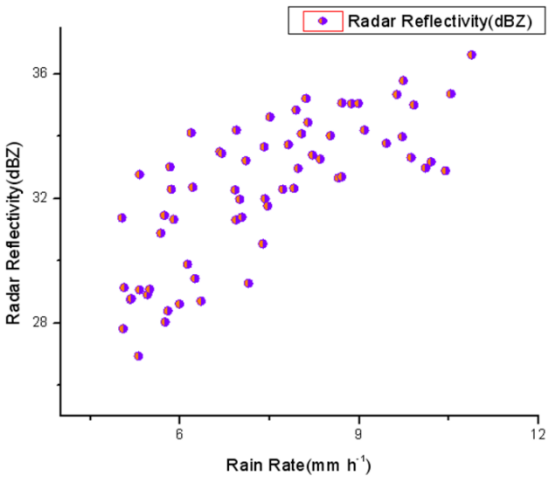

Fig.6. Rain Rate between5 to 10

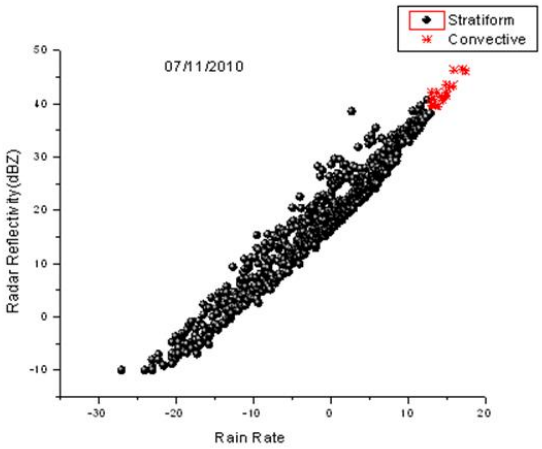

Fig.7. Precipitation at Cyclone Time

CONCLUSION

The real time data of the MRR Radar and other ground-based devices information lively update to the cloud via REST API.The updated cloud information will retender in UI via Streaming API'sCometD.We have illustrated a meteorological parameter of the rain fall at UI application and bale to read large volume of rainfall measurements from weather radar. The data visualization at application is implemented with advanced java Script libraries and cloud based lightning Locker service.D3 and Chart.Js libraries are robust interms of quick responsive and bel to render individual components information with Locker service.

We are currently working on further enhancements of the data visualization systems such as the complex and more retrieve the more critical summer data which is used for the agriculture field.

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