Web Application and Database Monitoring System of Automatic Weather Station (AWS)

Prateek Srivastava , Sneha Menon , Bhushan Wani , Utkarsh Shukla, Prof. Megha Patil

Computer Engineering Department, BVCOEL, Pune, India.

***Abstract*- Design and development of real-time weather monitoringsystem based on a web-application using Automatic Weather Station (AWS). The System consist of some AWS instruments and several sensors for collecting data and storing the data to the web server. Data from these weather sensors is collected by AWS Instruments using the some kind of software. The data is collected by satellite and using some communication, uploaded to FTP server and then stored on a web server. After every 15 minutes, GPRS sends a data packet to the server in this way live data is maintained. The Web application will search and reads the files and display the current (live) information provided by the web server. The system has successfully implemented real-time monitoring of weather through the web-application with a flexible interface and UI which will help user to use this web application anywhere.**

***Keywords*—AWS (Automatic Weather Station), FTP Server (Filetransfer Protocol), Web Server, General Packet Radio Service, Astra Satellite, Sutron Satellite, Cellcom Satellite.**

I. INTRODUCTION

Weather is an air condition in a certain place and in the relatively short time that includes conditions of temperature, humidity, and barometric pressure as its main component. Weather changes can be observed by using a device called Automatic Weather Station (AWS). AWS has been widely applied in various fields such as environmental research for geo-statistical, analysis of temperature measurement, prediction of wind energy potential location, measurement of the movement of the mass balance, and estimation of crop water needs.

The data from AWS is collected from satellite which stored in FTP server as sharable folder. This data is live data and FTP server is live server. Further this data is processed and calculated and displayed on web application. There are some quality checks such as range check, spatial check, temporal check. These checks will help to prevent getting false or incorrect data. Web application will monitor, maintain and display on webapp which can be easily accessible for user.

This research aims to develop a custom information system and UI design for the weather monitoring system. Therefore, it can be managed on a standalone web server and can be developed on a web application.

II. LITERATURE REVIEW

Paper:[1] Development of an Automatic Weather Monitoring System.

Author: E.L. Omoze, T.J. Timiyo, P.E. Orukpe.

Description: [1] Weather is the state of the atmosphere at a given timeand place with respect to cloudiness, hotness, heat, dryness, sunshine, wind, rain, etc.and it is difficult to predict. Weather monitoring plays an important role in various human endeavor. In this paper, we present the development of a low cost server-based AWS for remote locations. This work is built around a microcontroller unit (Arduino mega 2560 microcontroller), weather parameter sensors and a laptop computer. The data from the sensors were collected either hourly, daily, monthly or on a yearly basis. A webpage and a serial data capturing application were developed using notepad, hypertext markup language version 5and advanced serial data logger software respectively that logs and display real time weather conditions on the PC which can be monitored, accessed and downloaded by users remotely.The developed system worked satisfactorily.

Paper:[2] Design of Real-time Weather Monitoring System Based onMobile Application using Automatic Weather Station.

Author: Aris Munandar, Hanif Fakhrurroja, Muhammad IlhamRizqyawan, Rian Putra Pratama, Jony Winaryo Wibowo, Irfan Asfy Fakhry Anto.

Description: [2] This paper proposes the design of real-time weathermonitoring system based on a mobile application using Automatic Weather Station (AWS). The system connects to the AWS equipped with several sensors for collecting data and storing the data to the web server. Data from weather sensor is taken from the AWS-Davis Instrument using the WeatherLink software. The data is transmitted through the data logger using serial communication, uploaded via FTP and stored on a webserver. The Android application reads the files and displays the information provided by the web server in real-time. The system has successfully show real-time monitoring of weather through the mobile application with a flexibility in

 DOI : 10.35291/2454-9150.2021.0241

the parameters and the need of user interface (UI) design compared to the other solution.

Paper: Design of Weather Monitoring System Using Arduino BasedDatabase Implementation.

Author: Forat Falih Hasan, *Sarmad* Nozad Mahmood.

Description: This paper mainly combines between two-study fieldsbased control systems and data acquisition technique, to create a database system depending on the employed attributes to generate the presented data. The main attributes have been chosen based on the sensors used to build the system in order to create an effective weather station project. The proposed sensors used to measure and store Temperature, Humidity, and Wind speed data. The acquired data can be displayed in two ways identified as direct and indirect due to periodic data read and storing the data as real database system respectively. Real database creation technology is considered the main challenge of this work, which gives an opportunity to mine the data, recorded in the past. Furthermore, the entire system supervises and governs locations locally based on the periodic change that occurs in the climate conditions, in order to keep the proposed locations in desired weather situations. Finally, light sensing module is included with the module to provide weather station system by the information regarding day / night times based light intensity.

WHAT IS AWS?

[1] AWS is a meteorological station to observe the weather and to send the results automatically. In AWS, measuring tools reads or receives a data using the data acquisition device unit. The data from measurement devices can be processed locally at the AWS itself or processed in other places such as the central data processing. AWS can be designed in an integrated manner using a variety of measurement devices such as integration of instrument systems, interfaces and processing, and transmission unit called Automatic Weather Observing System (AWOS) or Automatic Surface Observing System (ASOS).

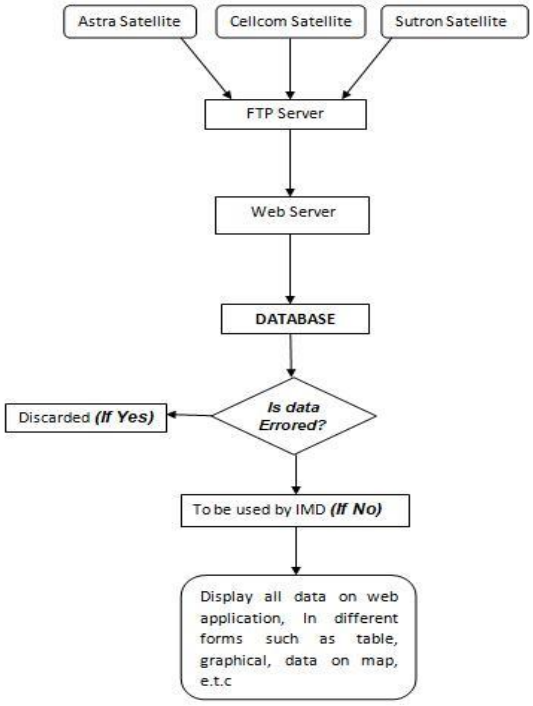
Based on presentation of the data, AWS can be grouped into real-time AWS and off-line AWS. Real-time AWS is a weather system that presents data in real-time. In general, this AWS is equipped with communication and alarm system to alert the user in case of extreme weather conditions. A real time AWS features has the collection of data units, the data storage and the wireless data communications using GSM/GPRS module that has capability for providing data communications in a wide range. Off-line AWS is weather stations that only record data and store data on storage media. Stored data can be retrieved at any time as necessary. AWS has features with several sensors, including a thermometer for measuring the temperature, an anemometer for measuring wind speed and direction, a hygrometer for measuring humidity, a barometer for measuring air pressure, a rain gauge for measuring rainfall and pyrometer for measuring solar radiation.

HARDWARE ANDSOFTWAREREQUIREMENTS

[2] Requirement for front end implementation HTML 5, CSS 3, Bootstrap. For back end implementation we used python 3, php-my-admin, XAMPP Server, django framework. Minimum requirements for operating system is windows10 64-bit.

RAM used is 8 GB DDR4. HDD used is 1TB Processor Intel Core I5-8th generation.

III. [1]AWS ARCHITECTURE



ARCHITECTURE AND SERVER IMPLEMENTATION

Figure 1: This explains the AWS architecture

AWS system consists of many servers and web application implementation.

A. Servers:

1) FTP Server: [6] There are python scripts which help collect the datafrom satellites such as ASTRA satellite, SUTRON satellite, CELLCOM satellite. These scripts fetch all data from all folder and change local data format to universal format and then final folder is sharable to our web server.

*2) Web Server:*The data here is stored by FTP server into Webserver. Python scripts will help to process this data and store it into MySQL database. Further these scripts will do some quality control checks. To avoid false and incorrect data. Quality control contains some types of checks like range check, Temporal check, spatial check.

3) RTH (Regional Telecommunication Hub): Here synop code scriptwill fetch the data from database and send it to RTH that is Regional telecomm hub.

4) NDC (National Data Centre): NDC will provide username andpassword for receiving, accessing, and monitoring database.

 DOI : 10.35291/2454-9150.2021.0241

B. Servers:

1) *FTP Server:* There are python scripts which help collect the datafrom satellites such as ASTRA satellite, SUTRON satellite, CELLCOM satellite. These scripts fetch all data from all folder and change local data format to universal format and then final folder is sharable to our web server.

2) *Web Server:*The data here is stored by FTP server into Webserver. Python scripts will help to process this data and store it into MySQL database. Further these scripts will do some quality control checks. To avoid false and incorrect data. Quality control contains some types of checks like range check, Temporal check, spatial check.

3) *RTH (Regional Telecommunication Hub):* Here synop code scriptwill fetch the data from database and send it to RTH that is Regional telecomm hub.

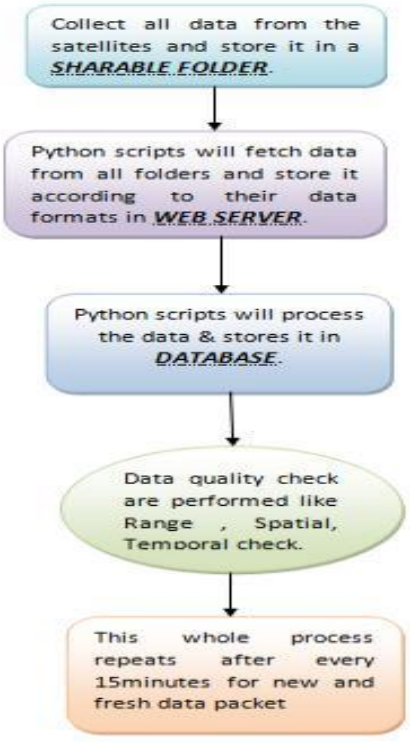
4) *NDC (National Data Centre):* NDC will provide username andpassword for receiving, accessing, and monitoring database.

AWS WORKFLOW

[1] The data which is getting from live server we will process the data by performing some calculations on this data such as finding DEW point, finding MSLP and so on.

Workflow for AWS web application:

Figure 2: This explains the AWS workflow



WORKFLOW

SOFTWARE IMPLEMENTATION

1) *UI Design:* [2] Web application for AWS (Automatic WeatherStation) contains hosting and serving systems. Web application has options like current data, AWS data, data on network.To get the AWS data of specific time, date and location there are options similarly current data can also be displayed on web application of particular location and time these all information is displayed through webapp with the help of languages like HTML, CSS, JS. To get access from database we used django framework which helps to connect database back- end and front-end.

2) *Analysis:* Analysis part contain all the python scripts writingwhich will perform calculation on data which is stored in database. Using some file handling and sharing operations we developed a database using MySQL and php-my-admin. Using some libraries of python like numpy, import os, shutil we perform operations on database, so whenever user requested any information it is processed and calculated by this python scripts and reflected on web app UI. For database implementation there are python scripts which will create the sharable folder coming from different AWS stations and store it in MySQL database where further operations are performed.

3) *Data on Network:* Data on network contain representation onAWS stations on map, for that we have to use matplot lib. This information can also be displayed in formats like line/bar/pie etc.

IV. GOALS AND OBJECTIVES

The focus is to develop weather monitoring system which includes data from AWS stations. Here data is collected from Satellites such as ASTRA, CELLCOM, SUTRON, this data is stored in sharable folder in FTP server .And after performing some analysis and calculations this data is displayed over web application.

The goal for web application is to implement weather monitoring system with low latency software and real time systems (live server).

If there is high latency and real time server doesn't work the data will be miss match and there will be wrong output.

Our Objective is to implement the AWS data on a state level successfully.

This Data contains Current data, AWS data, Data on network.

V. CONCLUSION

This paper presents the development of real-time weather monitoring system based on a web application using automatic weather station for state level. The system is able to display the information of the weather parameters via a web application. The application shows the real-time weather information through the table. The measurement parameter includes temperature, humidity, air pressure, rainfall and wind speed, wind DIR, GPS, SLP, MSLP, location of AWS station and so on. The user can monitor the weather continuously through this web application and can leverage the information to their needs. Through the development of this monitoring system, the cost of the service can be reduced, and the UI including the required weather parameters can be adjusted.

 DOI : 10.35291/2454-9150.2021.0241

REFERENCES & RESEARCH PAPERS

[1] E.L. Omoze , T.J. Timiyo, P.E. Orukpe, "Development of an Automatic Weather Monitoring System", IOSR Journal of Electricaland Electronics Engineering (IOSR-JEEE) e-ISSN: 2278- 1676,p-ISSN: 2320-3331, Volume 14, Issue 6 Ser. I (Nov. – Dec. 2019), pp.61-78.

[2] Munandar, Aris & Fakhrurroja, Hanif & Rizqyawan, Muhammad Ilham & Pratama, Rian & Wibowo, Jony

Anto, Irfan, "Design of real-time weather monitoring system based on mobile application using automatic weather station", 2017 2nd International Conference on Automation, Cognitive Science, Optics, Micro Electro--Mechanical System, and Information Technology (ICACOMIT), Jakarta,Indonesia, 2017, pp. 44-47.

[3] *"Budget 2011: Over 35% Hike of Department of Space"*. OutlookIndia. 28 February 2011. Archived from *the original* on 14 June 2012.

[4] World Meteorological Organization. Archived from *theoriginal* on 10 October 2011.

[5] *"Indian Meteorology Department (IMD)"*.Indian MeteorologyDepartment archived from *the original* on 31 January 2012.

[6] "*Design of Weather Monitoring System Using Arduino Based Database Implementation.*". Forat Falih Hasan, *Sarmad* Nozad Mahmood.

[7] *"Satellite Images & Products"*. Indian Meteorological Department.Archived from the original on 31 October 2011.

[8] *"Indian Meteorological Department"*. Archived from the originalon 21 July 2011

"Dr. Harsh vardhan dedicates system of aerosol monitoring and research and user-friendly website of India meteorological department". Press Information Bureau. pib.nic.in. 15 January2016. "*Meteorological service for international air navigation*".

[9] "www.imd.gov.in. "

[10] "www.aws.imd.gov.in:8091"

 DOI : 10.35291/2454-9150.2021.0241