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Automated Weather Station

Miss. Vrushali Hippargi[1], Prof. U. C Patkar[2]

[1]U.G. Student, Department of Computer Engineering, Bharati Vidyapeeth's College of Engineering, Lavale, India
[2]Assistant Professor, Department of Computer Engineering, Bharati Vidyapeeth's College of Engineering, Lavale, India

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Abstract - *This paper contains the compositions observing system and applications of AWS and PGMIS which are widely inaugurated in meteorological system. The brief discussion is finished on technical levels and control aspects of latest technology for Automatic lookout and grid Meteorological information system. Controlled by electronics devices or computer, the automated lookout automatically observes weather and collects and transmits data. AWS is composed of following: sensor, transmitter, processing device, data transmitting device, power supply. The transmitter converts weather parameters sensed by sensor into electric signal then; processing device will process these electrical signals and convert them into corresponding meteorological elements. Grid Meteorological information system (PGMIS) refers to the meteorological information comprehensive platform of grid applied in grid corporations within the least levels, which is additionally an expert application system together of meteorological information and production and operation of grid. The system provides timely and comprehensive meteorological information which is often related to the operation of grid to know monitoring, tracing, forecasting and warning of disastrous weather and also offers aid decision for load forecasting.*

Key Words: **AWS, PGMIS, Meteorological element, Sensor, Monitoring.**

1. INTRODUCTION

Automatic lookout (AWS) might be a completely unique application of wireless sensor within the sector of meteorological factor. Supported the technical communication, the structure and operation of automatic lookout is assessed in step with two different methods. It has always classified into real-time automatic lookout and non-real time automatic lookout in accordance with timeliness of information providing. Real-time automatic weather station: this kind of station can provide real-time weather observation data in step with specific time. Non-real time automatic weather station is a kind of station that only record and store observation data on daily basis, but it does not provide real-time weather observation data. The automated lookout is also classified into attended automatic station and unattended automatic station during a step with manual intervention condition of automatic lookout.

The automated lookout automatically acquires all or partial meteorological elements, like gas pressure, temperature, humidity, wind direction, wind velocity, rainfall, evaporation capacity, sunlight, radiation and Electrical and Electronics Engineering: a world Journal (ELELIJ) Vol 2, No 4, November 2013 ground temperature and so on, makes statistics of and encodes acquired weather data and transmits them to central station computer as per business demand. Automatic lookout is widely applied into meteorology power, hydrology, agriculture, environmental protection, airport, warehouse, scenic spots, territorial resources and scientific research. Grid monitoring and knowledge service might be a fundamental function of a grid system and Power Gird information security has been given particular attention. In installation Meteorological information system (PGMIS) which relates to the meteorological information comprehensive platform of installation employed in installation corporations the smallest amount bit levels and knowledge source of installation meteorological information system mainly comes from professional meteorological department, automatic lookout of wattage and lightning location system. The knowledge includes historical meteorological data, real-time weather data, forecast product and meteorological disaster information. The storage, assimilation and sorting of multi-information is finished through development of information communication and background pre-processing module. As for communication safety protection, the power grid meteorological information system is found in safety area, which exchanges data with systems of other protection regions through network isolation device. In theory, the format of information file exchange adopts E language text.

2. OBSERVATION FOR WEATHER STATION APPLICATION

The automatic weather observing system is automatic meteorological lookout during a very narrow sense and automatic meteorological observations post network during a very broad sense. The automated meteorological lookout network consists of 1 central station and a number of other other automatic weather stations through communication circuit, as shown within the correct figure (form network through GPRS/GSM communication). This system implements the data collection and processing through GPRS/GSM network. The network communicates through GPRS/GSM to Automatic weather observing system which has following functions such as calling real-time control of weather observation reports, automatically observing all of weather report and observation data files, observation data files, establish weather observation database, also remotely monitor operation status of system.

3. HARDWARE CONSIDERATIONS

3.1 METEOROLOGICAL SENSOR:

Recently meteorological sensors are actively introduced for climate monitoring. Meteorological sensor can sensor the change of measured meteorological elements and convert them into useful output and is typically composed of sensitive element and converter. The wind speed, wind direction, gas pressure, temperature, humidity and rainfall sensors used for 6-factor automatic observation post are mainly explained here. These sensors can detect, forecast a large range of parameters like storms, fog, floods, rainfall, wind shear and nuclear events.

3.2 WIND SPEED & WIND DIRECTION SENSOR:

Wind speed and wind direction sensors vary looking on environment or business demand. These sensors identifies the faults in automatic rain and wind measurement.

3.3 MECHANICAL WIND SPEED& WIND DIRECTION METER:

The wind direction part consists of mechanical device and converter. It's necessary to work out north firstly at the time of installation. When the mechanical device rotates consistent with change of wind direction, grey code or voltage signal is output in most cases. The device of wind speed sensor is three-cup wind component. When wind cups rotate because of being littered with horizontal wind, frequency signals are output in most cases. The measurements of time or frequency (Doppler conversion) is done by ultrasonic wind speed and wind direction meter which transmits sonic pulse that differs in receiving terminal to calculate wind speed and wind direction. Digital quantity is output in most cases. The info interface includes RS232, RS485 and SDI-12. There is no defect in ultrasonic type meter caused by friction loss of mechanical type meter.

3.4 AIR PRESSURE SENSOR:

Atmospheric pressure sensor converts change of gas pressure into electrical signal and measures and processes electric signal through electronic measuring circuit to get pressure value. The mostly used electrical pressure sensors are generally vibration cylinder pressure sensor and capsule capacitor pressure sensor. Data are usually output in style of analogue quantity 4~20mA and digital quantity SDI-12, etc.

3.5 TEMPERATURE SENSOR:

The commonly used platinum resistance temperature sensor measures temperature in line with the characteristic that platinum resistance varies with its temperature. When the measured medium has gradient, the measured Electrical and Electronics Engineering: a global Journal (ELELIJ) Vol 2, No 4, November 2013 temperature is seemed because the average temperature of dielectric layer where temperature device is. The analogue or digital quantity for data acquisition and processing unit may be output through signal converter.

3.6 HUMIDITY SENSOR:

The humidity sensor has humidity sensitive element that includes two types: resistance type and capacitor type. The humidity sensitive resistance refers to hide a movie made from humidity sensing material on substrate. When water vapor in air is absorbed onto the film, both resistivity and resistance of element vary. When humidity in environment changes, the dielectric constant of humidity sensitive capacitor also changes and the capacitor variation is in direct proportion to ratio. The analogue or digital quantity for data acquisition and processing unit may be output through signal converter.

3.7 RADIATION FILED:

The temperature and humidity weather sensors are usually installed outdoors during construction of automatic meteorological observation post. Therefore, they have to be protected with radiation shield (instrument shelter). Currently, some sensor manufacturers have integrated temperature sensor and humidity sensor together and install them directly in radiation shield.

3.8 RAIN FALL SENSOR:

Various weather stations, hydrologic stations and environmental protection, agriculture and forestry defection departments use rainfall sensor to live the rainfall of some place at a while and convert the rainfall into switching quantity, analogue quantity or digital quantity signals which might be measured. The rainfall sensor consists of single tipping-bucket type, dual tipping-bucket type and multi-tipping-bucket type, etc. In most weather stations, the rainfall sensor with 0.1mm resolution is employed.

4. APPLICATION OF AUTOMATIC OBSERVATION POST:

The one of many applications of Automatic Observation Post is as follows:

4.1 STANDARD AUTOMATIC OBSERVATION POST

The standard automatic observation post is micro-power station designed per ground weather automatic monitoring specifications with features of wide temperature range, low power consumption, high reliability and anti-interference, etc. this sort of observation post can measure air temperature, humidity, rainfall, wind direction, wind speed, atmospheric pressure, ground temperature, radiation, sunlight, evaporation and other parameters and can also access other meteorological sensors per actual demand. The quality automatic observation post has got to be established in a very especially suitable place per requirement of administrative unit. The standard automatic observation post processes data as follows:

-The rate of air temperature, humidity, atmospheric pressure, ground temperature and radiation is 6 times per minute. Remove the utmost and minimum values. Then, average the remaining 4 sampling values. The common value of 1 minute is instantaneous value.
-The rate of wind direction and wind speed is once per second. Determine the moving average values of three seconds, 2 minutes and 10 minutes. The common value of three seconds is instantaneous value. The rate of rainfall, evaporation and sunlight is once per minute.

5. POWER GRID METEROLOGICAL INFORMATION SYSTEM (PGMIS):

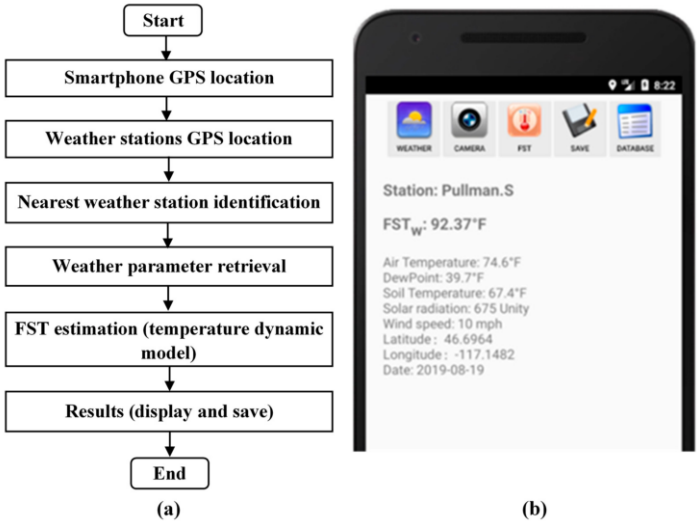
The automatic weather observing system is automatic meteorological observation post in a very narrow sense and automatic meteorological observation post network in a very broad sense. The automated meteorological observation post network consists of 1 central station and several other automatic weather stations through communication circuit. The implementation of data collection and processing through GPRS/GSM network is done by this system. Automatic weather observing system has functions such as automatically observe all meteorological elements, calling and real-time control of weather observation reports and observation data files, compile and store various varieties of weather report and observation data files, realize transmission, establish weather observation database and remotely monitor operation status of system. From the structural diagram, each component of automatic meteorological observation post can Electrical and Electronics Engineering: a world Journal (ELELIJ) Vol 2, No 4, November 2013 be seen.

6. SYSTEM FUCTION:

In Data access and communication information source of installation meteorological system chiefly occurs from professional meteorological department, automatic lookout of electrical power and lightning location system. The database of installation meteorological system adopts DB2 or domestic electronic information service (DM, Neusoft Open BASE, etc.). Its inner part will be logically divided into real-time database and historical database. The real- time database is employed to save lots of original meteorological data acquired from automatic lookout, including air temperature, rainfall, humidity, wind direction, wind velocity, atmospheric pressure then on. The historical database consists of employed to accumulate and saved meteorological data, meteorological processing data (e.g. static value of meteorological element), meteorological product (e.g.: cloud atlas and radar mosaic), weather outlook, operation log and other text information. Besides, the historical database can save multiple styles of data, including numerical value, characters, text message, picture and binary files of other formats.

7. SOFTWARE CONSIDERATIONS:

Flowchart for weather information application-



8. PGMIS APPLICATION FUNCTION:

Display of meteorological information: the particular condition display of meteorological elements, Real-time monitoring of meteorological elements: display real-time metrological elements (including air temperature, rainfall and cloud cover, atmospheric pressure, humidity, wind velocity, wind direction) of important cities on map. Click the proper key to display list query. Real-time query of meteorological elements: program displays data query table and graph (line graph or bar graph) and isothermal graphic display: display real-time isothermal on GIS graph and fasten illustration for description.

- Statistical data display of meteorological elements: The statistical data query of meteorological elements: program displays data query table and graph (line graph or bar graph), graphic display of rainfall isoline: display historical rainfall isoline on GIS graph and fasten illustration for description, Comparative display of real-time meteorological elements and historical average data: program displays the comparative analysis curve of real-time meteorological elements and historical average data.
- Display of forecast information: The table query of forecast data, the query content of weather value forecast includes the forecasted temperature, wind velocity, wind direction, atmospheric pressure, rainfall, humidity and total bad weather of every hour in future 36 hours since user selects the time, the historical forecast data may be inquired, the query date may be set and display region refers to every prefecture-level city.

-Comparative analysis of temperature forecast graph: The monitoring of temperature value forecast graph: program displays multiple temperature graphs (line graph), including comparison of forecast temperature graph and actual temperature graph, display temperature forecasting value of

every region in future 36 hours in sort of graph, multiple region lists may be selected to comprehend comparison of regional temperature forecast graph and display region refers to every prefecture-level city.

- Display of forecast information: Display of prognosis product, Display of prognosis product includes text display and movie display. The displayed content includes conventional forecast, text forecast and early warning and city prognosis, the static page displays the newest daily, weekly, monthly and quarterly forecast texts, Texts and text files of historical forecast may be inquired, Random time may be selected to inquire forecast product.
- Dynamic display of satellite cloud picture and radar image: Display the satellite cloud picture and radar image in past in the future future} in the sort of static picture. Display the satellite cloud picture and radar image in past sooner or later through picture overlapping and auto play, Overlap satellite cloud picture and radar image on WEBGIS to comprehend regional location display. The satellite cloud picture and meteorological radar image of any time may be inquired.

9. FUTURE SCOPE

In future, this system may be used to store the ancient data that is the Big Data. This application can be used in research department as it contains the ancient data. Retrieval of data can be easy. This application can reduce the complexity in future.

10. CONCLUSION

The meteorological data are quite relative to our production and life and is extremely significant for all countries, enterprises or individuals. Within the increasingly serious natural environment, meteorological data provides safety protection for us to forestall natural disaster and fairly use natural energy. With scientific and technological progress, the development and application of automatic observation post (AWS) and grid meteorological data system (PGMIS) are more advanced with more precise and timely data, making us have more progress in future communication and luxuriate in beautiful living environment. The brief discussion is finished during this paper and also illustrated their principle, function application and also append throughout overview at technical levels of the system. The aim of this text is to ensure the standard control of automatic observation post data & grid meteorological data system.

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