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Smart Air and Sound Pollution Forecasting using IOT

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Abstract:
Utilizing observational investigation, customary air programmed observing framework has high accuracy, yet vast mass, high cost, and single datum class make it incomprehensible for expansive scale establishment. In light of introducing Internet of Things (IOT) into the field of natural assurance, this paper advances a sort of ongoing air contamination observing and gauging framework. By utilizing IOT, this framework can lessen the equipment cost into 1/10 as previously. The framework can be spread out in an extensive number in checking territory to frame observing sensor. Other than the elements of regular air and sound programmed checking framework, it likewise displays the capacity of estimating advancement pattern of air and sound contamination inside a specific time extend by breaking down the information gotten by front-end recognition framework as per neural system technology. Targeted crisis transfer measures can be taken to limit misfortunes in useful application.

Keywords: Neural Network, Air Quality Monitoring, Sound Quality Monitoring, Air Pollution Forecast, Sound pollution Forecast.

I. INTRODUCTION (*HEADING 1*)

With the fast advancement of economy, synthetic modern park development and generation movement are progressively visit, prompting expanding likelihood of natural contamination mishaps, particularly air and sound contamination mishap. Influenced by meteorological and land conditions, air and sound contamination will be profoundly bunched in a short time in the wake of occurring, causing extraordinary damage or even outrageous demolition to both human and condition. So, it is especially critical to set up a continuous air and sound contamination checking framework. II utilizing research facility investigation, ordinary air programmed checking framework has moderately complex hardware innovation, extensive mass, insecure task and staggering expense. staggering expense and vast mass make it incomprehensible for huge scale establishment. this framework must be introduced in key checking areas of some key endeavors, in this manner framework information is inaccessible to anticipate by and large contamination circumstance. to defeat imperfections of customary checking framework and discovery techniques and decrease test cost, this paper proposes a strategy joining iot innovation with condition checking. by supplanting observing hardware in conventional experimental investigation with sensor organize in ioc innovation, through which modest sensors can be laid out adapt ably in the entire zone to screen omni-directionally to give information backing to forecast. Ease of use

II. ACKNOWLEDGEMENT OF THE SYSTEM

As per IOT engineering, the framework is for the most part made out of recognition layer, arrange layer and application layer. The framework's basic structure engineering is appeared figure 1. In recent application, current climate conditions (temperature, stickiness, wind course, wind speed, and so forth) and topographical conditions have huge impact on air contamination degree and dirtying source dissemination. In the procedure of framework execution, along these lines, a full thought ought to be taken to the impact of natural factors on checking and forecast impact Maintaining the Integrity of the Specifications

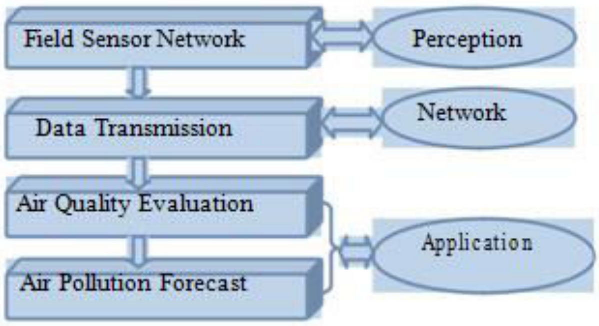

Figure 1

B. Realization of Perceptual Layer Architecture

Perception layer mainly includes Field Sensor Network which based on front-end acquisition device. The slather of sensors reduces the cost of hardware. In traditional system, we spent more than $100,000 for one environmental parameter in a monitoring point. In this system, we can monitor at least five kinds of environmental parameters in one monitoring point and the cost under $10, 000. Perception layer is realized mainly by establishing a stable and reliable monitoring network system, including monitoring sites selection, environment sensor deployment and meteorological sensor deployment, etc. Generally, such typically sensitive areas as production area and boundary are selected as monitoring points. Different models are built for the possible leaking ways of different hazards sources (point source, non-point source, instantaneous explosion, continuous type). Monitoring points layout scheme is optimized by considering influence of the regions climate on pollutant diffusion range and intensity, population density, important target areas and key equipment areas comprehensively. In environmental sensor deployment, all kinds of environmental sensors are installed in monitoring points, including sulfur dioxide, nitrogen dioxide, smog, inhalable particle, carbon monoxide, chlorine, hydrogen chloride and hydrogen fluoride sensors. Meteorological sensors are installed in some of the monitoring points in the deployment. Meteorological parameters including wind direction, wind speed, temperature, humidity and air pressure can be perceived in real time to assist in pollution situation analysis and pollution diffusion forecast.

C. Realization of Network Layer

Transmission system is built according to service-oriented requirement. By using XML as information exchange language, data is encapsulated based on unified information exchange interface standard and data exchange protocols. By using message passing mechanism, information communication, data exchange between basic data and business data and transfer of control instruction are realized so as to integrate business collaboration and application system. By embedding data validation module and fault-tolerant processing module, error data including empty value, high value, low value and negative value are *screened* preliminarily and the data within fault tolerance scope is put in data base for operation.

D. Realization of Application Layer

The whole application layer system is mainly to process and analyze air pollutant data, evaluate air quality and then predict the trend air quality develops over a period of time in the future. From a functional point of view, the whole application layer includes air quality evaluation and air pollution forecast. Due to complex relationship between air quality, air pollutants trend and meteorological factors, it is difficult to mine the useful information in historical data to predict accurately with traditional prediction method. In this system, we introduced neural network technology. Neural network, characterized by nonlinear processing and multivariable input and output, are used to mine mass of data sent back by perception layer and network layer. Model is created based on the study of input data instead of established equation. With the help of strong nonlinear processing ability afforded by neural network, accuracy of air quality assessment and pollution prediction can be improved so as to make up the inadequacy of the traditional method. In air quality evaluation, by analyzing quality indexes including temperature, harmful gas concentration, particle concentration, taking environmental factors different applications as parameters and using the genetic algorithm and neural network technology, key indicators of air quality are chosen. In addition, quantitative relationship model of atmospheric quality factor and level is established using self-organization modeling and grey system control modeling to realize comprehensive evaluation and analysis of atmospheric quality. As the core of the whole system, air pollution prediction is a multiple-input- multiple-output forecasting tool based on neural network technology. It has high extensibility and can be used for different applications. Air quality prediction is to predict future trend of air quality based on current situation, pollutant dispersion, current weather conditions and geographical position of monitoring area, so as to provide decision support for emergency disposal and rescue after pollution accident happens. By taking air quality indexes as neural network of training sample, air quality index parameters in the following time node as expected output, and by grasping the inherent law between meteorological factors (such as temperature, wind direction) and air quality, this system can achieve accurate prediction of air quality. Evaluation weight of different quality indexes are studied based on their influence on overall evaluation of air quality. A synthetic method for comprehensive air quality index verified by experiment is established to create a set of accurate and effective air quality evaluation system.

III. DATA PROCESSING OF THE SYSTEM

According to the relationship between current pollutant concentration and the pollutant concentration in the past 24 hours, a 24 hours' prediction network is established. The average pollutant concentration is adopted to train network and then predict the pollutant concentration per hour in next 24 hours. In network training, inputs are endowed with the same important position to prevent neurons output saturation caused by large absolute value of net input. The scale transformation of data is based on normalization method in this system. We build two matrices, input matrix P and target matrix T. The structure of every matrix is 24*365(i*j), the line ' i' (i=1, 2, 3…24) means some hour of a day, the column ' j' (j=1, 2, 3..365) means some day of a year. The column ' j' of target matrix is the column ' j+1' of input matrix. Parameter setting of pollution forecast networks is shown in table 1. Due to close relationship between air pollution forecast and meteorological factors, much meteorological data is used in this system including daily mean temperature, average dew point temperature, average sea level pressure, average pressure of monitoring station, visibility, average wind speed, max sustained wind speed, max gust velocity, highest temperature, lowest temperature, total precipitation, snow depth and probability index of extreme weather. This system is used in a chemical industrial park near sea. We build two models for different seasons according to the geography and climate. The system is dived two parts throng competitive network, one includes January, February, November, December, another includes April, May, June, July, August, September, October.

Table.1. Parameter setting of pollution prediction network

Project	**Parameter Setting**	
Layer number of networks	Input layer. Hidden layer. Output layer	
The nodes of each layer	Input layer	**24**
	Hidden layer	**4**
	Output layer	**1**
Transfer Function	Hidden layer	Tansig
	Output layer	Logsig
Learning Algorithm	Bayesian Regularization	
The Maximum training times and expectation errors	5000	0.001
Initialization method of weight	Initial weight of hidden layer *0.1 output layer set positive and negative initial weight equally.	
Division method of Samples	Training set: Validation set: Test set=2:1:1	

We add five meteorological factors to the model of air pollution forecast including daily mean temperature, air pressure, visibility, average wind speed and total precipitation, by progressive regression analysis (90% confidence). After adding meteorological factors, the nodes of input increases to 29 and the nodes of hidden layer increases to 6. By comparison of the prediction performance between includes meteorological factors and without meteorological factors (fig 2), it is found that adding meteorological factors can improve the prediction performance greatly.

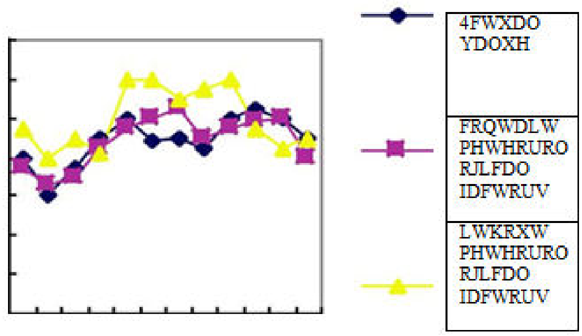

FIGURE 2
COMPARISON OF FORECAST EFFECT OF PARAMETERS INPUT CONTAINING WEATHER FACTORS.

To establish artificial neural network, we need mass data as the input. We show the results of prediction models which are based on recent 5 years' data. The figure 3 shown that enlarge sample data can improve prediction performance, but can' t be too large. Using recent 3 years' data as input and following the modeling method, the system can reduce prediction 12%~23%.

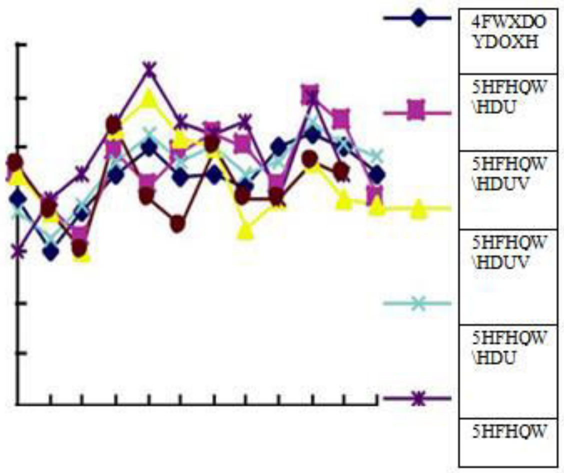

Figure.3. Comparison of networks prediction values and true value from different sample set

IV. CONCLUSION

Air pollution monitoring and forecasting system designed in this paper proposed a good solution to the complexity of air pollution. The use of a large number of sensors ensures monitoring accuracy, reduces monitoring cost and makes monitoring data in monitoring area more systematic and perfect. A large number of field data provided by front-end sensor network makes big data analysis in background application layer more direct and effective, providing a real and effective decision -making basis for emergency response after pollution accident happens.

V. REFERENCES

[1]. MaryT, O' Mahony, Donal D, Alice O' Sullivan, et al. Emergeney planning and the Control of Major Accident Hazards Dircetive: An approach to determine the Public safety zone for toxic cloud releases. Journal of Hazardous Materials, 2008, 154:355-365.

[2]. Gouldson A, Morton A, Pollard SJ T. Better environmental regulation – contributions from risk -based decision -making. Science of the Total Environment, 40719:5283-5288.

[3]. Hoi KI, Yuen KV Mok KM. Prediction of Daily Averaged PM10 Concentrations by Statistical Time – Varying Model. Atmospheric Environment 2009 43 16 2579-2581.

[4]. Yazdanpanah H. Karimi M. Hejazizadeh Z. Forecasting of Daily Total Atmospheric Ozone in Isfahan Environmental Monitoring and Assessment vol.157(: 1-4) PP235~241 OCT 2009.

[5]. Qin, X Su, JZ Liu, W, et al. Application of Data Mining Based on Neural Networks in Ozone Concentration Forecast. Progress in Environmental Science and Technology, Vol II, Pts A and B pp 744-746 2009

[6]. Hui XIE Fei MA Qing-yuan BAI. Prediction of Indoor Air Quality Using Artificial Neural Networks, 2009 Fifth International Conference on Natural Computation (ICNC 2009), PP414~18, 2009.

[7]. Aiger M, et al, Internet of Things in 2020.Eposs, May, 2008.

[8]. Ning Bin, Wu Yuchuan. Research on non-contact infrared temperature measurement. 2010International Conference on Computational Intelligence and Software Engineering. 2010.

[9]. Maheshwari GP, Al-Taqi H, Al-Murad R, Suri RK.Programmable thermostat for energy saving. Energy and Build. 2001.

[10]. LuiSha, Sathish Gopala bkrishnan, XueLiu, et al.Cyber-physical systems:a new frontier. Proceedings of 2008 IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing . 2008.

[11]. YAN B, HUANG G W.Application of RFID and internet of things in monitoring and anti-counterfeiting for products. International Seminar on Business and Information Management. 2008.

[12]. PUJOLLE G.An autonomic-oriented architecture for the Internet of Things. IEEE John Vincent Atanasoff 2006 International Symposium on Modern Computing. 2006.

[13]. Tarek Abdelzaher.Research Challenges in Distributed Cyber-Physical Systems. IEEE/IFIP International Conference on Embedded and Ubiquitous Computing. 2008.

[14]. Ge Yanhong, Li Wenfeng, LiBin.Design of Remote MonitoringSystem of Network Robot Based on Internet. Proc.of ISECS International Colloquium on Computing, Communication, Control, and Management. 2009.

[15]. M.C. Naldi, R.J.G.B. Campello, E.R. Hruschka, A.C.P.L.F. Carvalho. Efficiency issues of evolutionary k -means[J]. Applied Soft Computing Journal. 2010 (2).

[16]. Kranz, Matthias, Holleis, Paul, Schmidt, Albrecht. Embedded Interaction: Interacting with the Internet of Things [J]. IEEE Internet Computing. 2010 (2).