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APPLYING INTERNET OF THINGS (IOT) IN ANALYZING FRONT –END PERCEPTION TO BUILD AN AIR AUTOMATIC OBSERVANT FORECASTING SYSTEM INLINE WITH NEURAL NETWORK TECHNOLOGY AND TARGETED EMERGENCY DISPOSAL MEASURES FOR CONTROLLING AIR POLLUTION

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ABSTRACT

Using discovered study, typical air automatic observant system has high preciseness, however giant bulk, high cost, and single information category build it not possible for large-scale installation supported introducing internet of Things(IOT) into the sector of environmental protection, this paper puts forward a sort of time period pollution watching and foretelling system. By mistreatment IOT, this method will cut back the hardware price into 1/10 as before. The system is ordered go in an oversized range in watching space to create watching device network. Besides the functions of typical air automatic watching system, it additionally exhibits the operate of foretelling development trend of pollution among a precise time vary by analyzing the information obtained by front-end perception system in line with neural network technology. Targeted emergency disposal measures are taken to attenuate losses in utilization.

I. INTRODUCTION

With the rapid development of economy, chemical industrial park construction and production activity are increasingly frequent, leading to increasing probability of environmental pollution accidents, especially air pollution accident. Influenced by meteorological and land conditions, air contamination will be exceptionally grouped in a brief timeframe subsequent to occurring, causing awesome damage or even extraordinary devastation to both human and condition. So it is especially imperative to set up a continuous air contamination checking framework. Utilizing lab examination, customary air programmed checking framework has generally complex gear innovation, expansive mass, flimsy activity and staggering expense. Surprising expense and expansive mass make it incomprehensible for huge scale establishment. This framework must be introduced in key checking areas of some key ventures, accordingly framework information is inaccessible to foresee generally contamination circumstance. To conquer imperfections of

conventional observing framework and recognition strategies and diminish test cost, this paper proposes a technique combining IOT technology with environment monitoring. By replacing monitoring equipment in traditional empirical analysis with sensor network in IOC technology, through which inexpensive sensors can be laid out flexibly in the whole area to monitor Omni-directionally to provide data support for prediction.

II. REALIZATION OF THE SYSTEM

As per IOT engineering, the framework is fundamentally made out of recognition layer, organize layer and application layer .The system's integral design architecture is shown infigure 1. In practical application, current weather conditions (temperature, humidity, wind direction, wind speed, etc) and geographical conditions have significant effect on airpollution degree and polluting source diffusion. In the process of system implementation, therefore, a full consideration should be taken to the influence of environmental factors on monitoring and prediction effect.

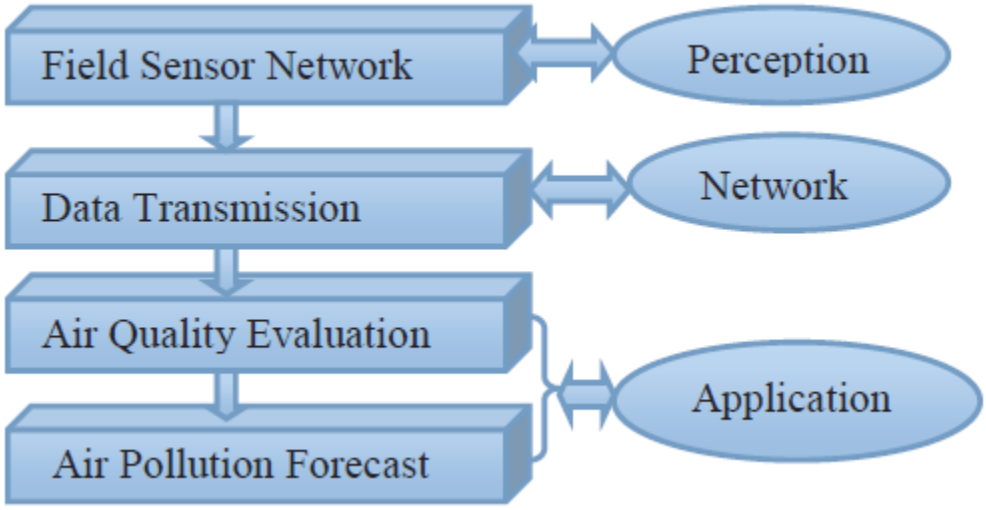

Figure. 1 System's Integral Design Architecture

A. Realization of Perceptual Layer Architecture

Discernment layer chiefly incorporates 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 parameters 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 .By and large, such commonly delicate regions as generation zone furthermore, limit are chosen as checking focuses. Different models

are built for the possible leaking ways of different hazards sources (point source, non-point source, instantaneous explosion, continuous type). Checking focuses format plot is improved by considering impact of the locale's atmosphere on poison dissemination range and force, populace thickness, critical target regions and key hardware regions completely. In natural sensor organization, numerous sorts of ecological sensors are introduced in checking focuses, including sulfur dioxide, nitrogen dioxide, exhaust cloud, inhalable molecule, carbon monoxide, chlorine, hydrogen chloride and hydrogen fluoride sensors. Meteorological sensors are introduced in a portion of the observing focuses in the sending. Meteorological parameters including wind heading, wind speed, temperature, mugginess and pneumatic force can be seen continuously to aid contamination circumstance investigation and contamination dissemination estimate.

B. Realization of Network Layer

The essential capacity of system layer to transmit natural and meteorological information, interface all the air sensors and meteorological sensors conveyed in checking region to a focal server and transmit the information seen by sensors to server farm progressively. 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 utilizing message passing component, data correspondence, information trade between fundamental information and business information and exchange of control guidance are acknowledged in order to coordinate business joint effort and application framework. 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.

C. Realization of Application Layer

The entire application layer framework is predominantly to process and examine air toxin information, assesses air quality and after that anticipate the pattern air quality creates over some stretch of time later on. From a functional point of view, the whole application layer includes air quality evaluation and air pollution forecast. Due to complex relationship between airquality, 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 framework, we presented neural system innovation. Neural system, described by nonlinear handling and multivariable information and yield, are utilized to mine mass of information sent back by recognition layer and network layer. Model is created based on the study of input data instead of established equation. With the help of strong non linear 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.

III. DATA PROCESSING OF THE SYSTEM

According to the relationship between current pollutant concentration and the pollutant concentration in the past 24hours, 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 next24 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 is24*365(i*j), the line 'i' (i=1, 2, 3….24) means some hour of 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.

Because of cozy connection between air contamination figure and meteorological components, much meteorological information is utilized in this framework including day by day mean temperature, normal dew point temperature, normal ocean level weight, normal weight of observing station, deceivability, normal breeze speed, max maintained breeze speed, max blast speed, most astounding temperature, least temperature, add up to precipitation, snow profundity and likelihood record of extraordinary climate. This framework is utilized in a synthetic modern stop close ocean. We assemble two models for various seasons as per the topography and atmosphere. The framework is jumped two sections crowd aggressive system, one incorporates January, February, November, December, another incorporates April, May, June, July, August, September, October. TABLE 1. Parameter setting of contamination forecast arrange.

Project	**Parameter setting**	
Layer number of network	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 max training times and expectation error	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). In the wake of including meteorological elements, the hubs of informationincrements to 29 and the hubs of concealed layer increments to 6. By correlation of the forecast execution between incorporates meteorological components and without meteorological factors (fig 2), it is discovered that including meteorological elements can enhance the forecast execution significantly.

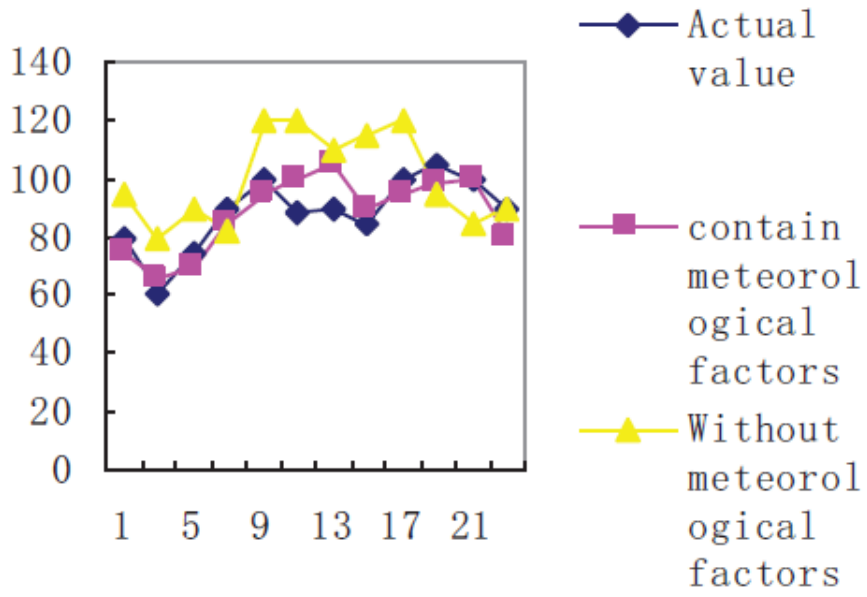

Figure. 2. Comparison of forecast effect of parameters input containing weather factors or not Comparison of forecast effect of parameters input containing weather factors or not

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%.

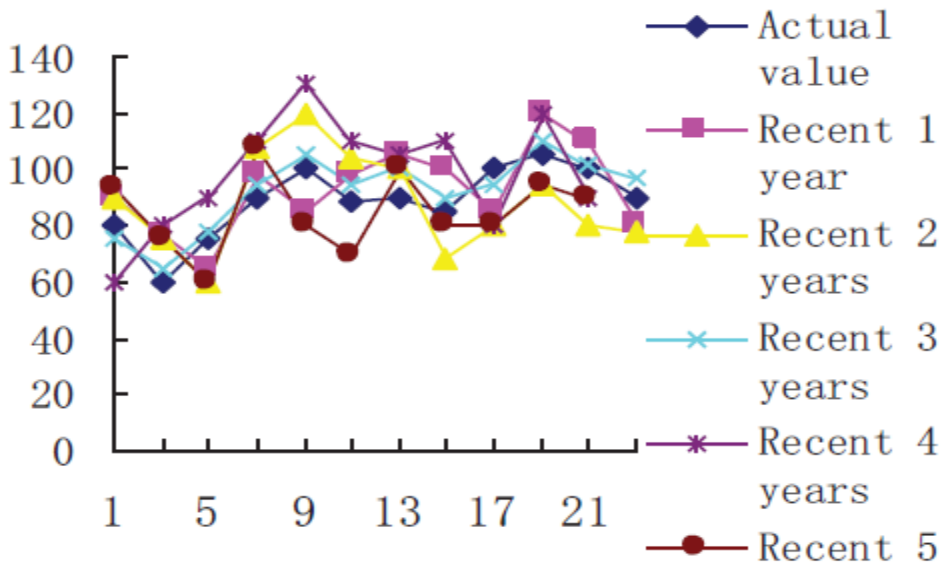

Figure3 Comparison of network's prediction values and true value from different sample set