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ANALYZING AIR POLLUTION FORECASTING SYSTEM MODELS TO DEVELOP AN INNOVATIVE IOT BASED NEURAL NETWORK AIR QUALITY MONITORING FORECASTING AND TARGETED EMERGENCY DISPOSAL SYSTEM

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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 net 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 is taken to attenuate losses in utilization.

I. INTRODUCTION

With the rapid development of economy, chemicalindustrial park construction and production activity areincreasingly frequent, leading to increasing probability ofenvironmental pollution accidents, especially air pollutionaccident. 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 techniquecombining IOT technology with environmentmonitoring. By replacing monitoring equipment intraditional empirical analysis with sensor network in IOCtechnology, through which inexpensive sensors can be laidout flexibly in the whole area to monitor Omni-directionallyto provide data support for prediction.

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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) andgeographical conditions have significant effect on airpollution degree and polluting source diffusion. In theprocess of system implementation, therefore, a fullconsideration should be taken to the influence ofenvironmental factors on monitoring and prediction effect.

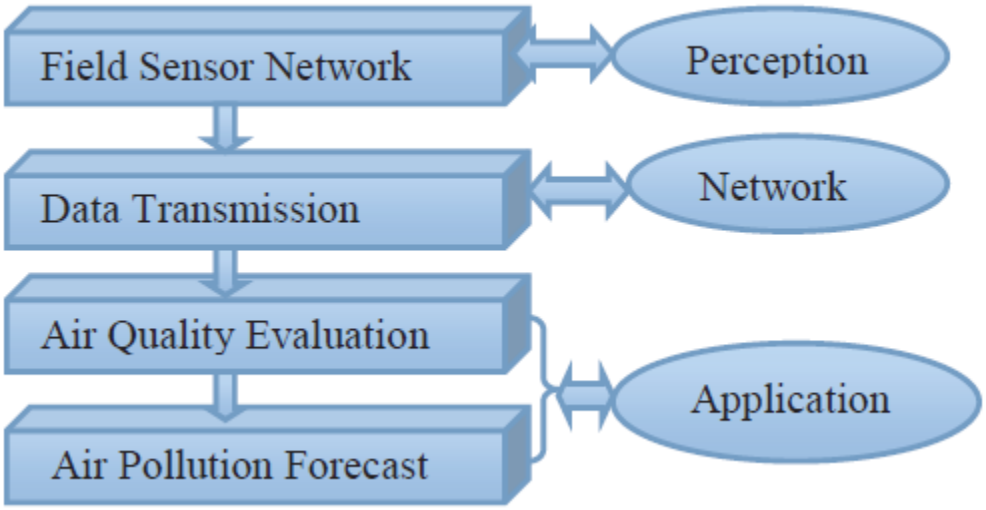

Figure. 1 System's Integral Design Architecture

A. Realization of Perceptual Layer Architecture

Discernment layer chiefly incorporates Field Sensor Network which based on front-end acquisition device. The slather ofsensors 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 canmonitor at least five kinds of environmental parameters inone monitoring point and the cost under $10, 000.Perception layer is realized mainly by establishing a stableand reliable monitoring network system, includingmonitoring sites selection, environment sensor deploymentand meteorological sensor deployment, etc.By and large, such commonly delicate regions as generation zone furthermore, limit are chosen as checking focuses. Differentmodels are built for the possible leaking ways of differenthazards 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 hydrogenfluoride sensors. Meteorological sensors are introduced in a portion of the observing focuses in the sending. Meteorological parameters including wind

heading, wind speed, temperature, [3] 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 isbuilt according to service oriented requirement. By using XML as information exchange language, datais 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. Byembedding data validation module and fault-tolerantprocessing module, error data including empty value, highvalue, low value and negative value are screenedpreliminarily and the data within fault tolerance scope is putin data base for operation.

C. Realization of Application Layer

The entire application layer framework is predominantly to process and examine air toxin information, assess 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 wholeapplication layer includes air quality evaluation and airpollution forecast. Due to complex relationship between airquality, air pollutants trend and meteorological factors, it isdifficult to mine the useful information in historical data topredict 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. Modelis created based on the study of input data instead ofestablished equation. With the help of strong nonlinearprocessing ability afforded by neural network, accuracy ofair quality assessment and pollution prediction can beimproved so as to make up the inadequacy of the traditionalmethod.

III. DATA PROCESSING OF THE SYSTEM

According to the relationship between current pollutantconcentration and the pollutant concentration in the past 24hours, a 24 hours' prediction network is established. Theaverage pollutant concentration is adopted to train networkand then predict the pollutant concentration per hour in next24 hours.In network training, inputs are endowed with the sameimportant position to prevent neurons output saturationcaused by large absolute value of net input. The scaletransformation of data is based on normalization method inthis system. We build two matrices, input matrix P andtarget matrix T. The structure of every matrix is24*365(i*j), the line 'i' (i=1, 2, 3….24) means some hour ofa day, the column 'j'(j=1, 2, 3…365) means some day of

ayear. The column 'j' of target matrix is the column 'j+1' of input matrix. Parameter setting of pollution forecastnetworks 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, perceivability, 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 airpollution forecast including daily mean temperature, airpressure, visibility, average wind speed and totalprecipitation, 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.

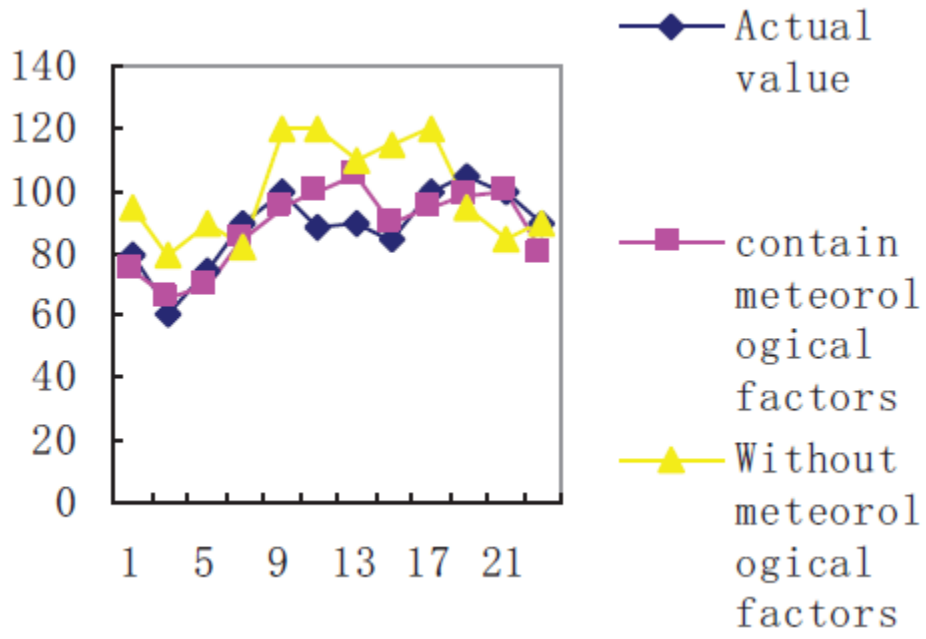

Figure. 2. Comparison of forecast effect of parameters input containing weather factors or not Comparison of forecast effect of parameters input containing weather factors or not

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

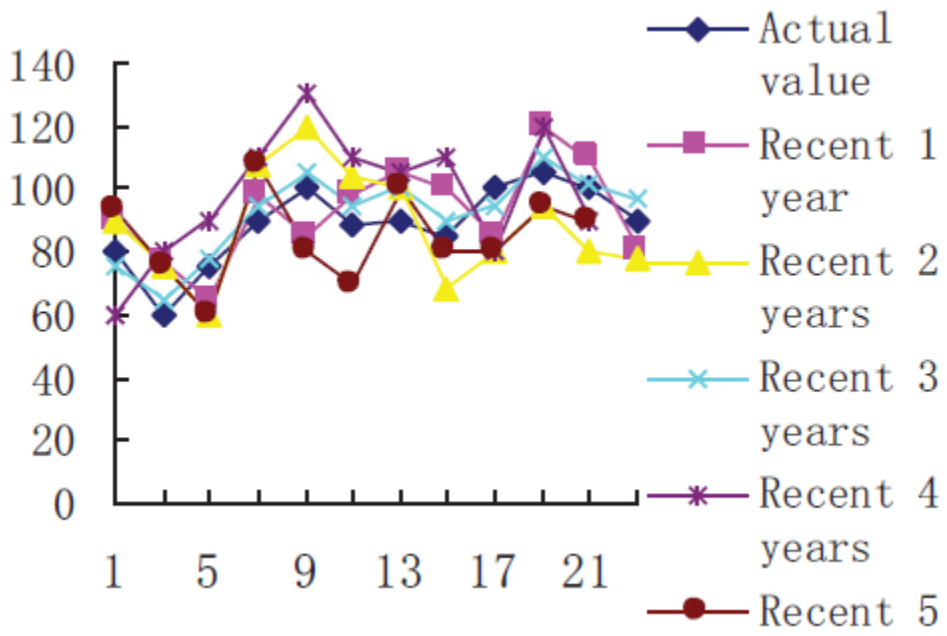

Figure3 Comparison of network's prediction values and true value fromdifferent sample set

IV. CONCLUSION

Air contamination observing and determining framework outlined in this paper proposed a decent answer for the intricacy of air contamination. The utilization of countless guarantees observing precision, decreases checking cost and makes observing information in observing region more orderly and immaculate. A substantial number of field information given by front-end sensor organize makes huge information investigation in foundation application layer more straightforward and viable, giving a genuine and powerful basic leadership reason for crisis reaction after contamination mischance occurs.