International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970)
Volume-2 Number-2 Issue-4 June-2012

Application of Value Engineering in Wireless Nano- sensor Network to Monitor Global warming Affected by Uncontrolled Urbanization

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Abstract

In the present scenario weather uncertainty is established as the greatest collective challenge faced by human beings. It is also well established that in weather science the most crucial variables are the least well predicted. Assessments of weather change impacts, which are useful for stakeholders and policymakers, depend critically on regional and decadal scale projections of weather extremes. Thus, weather scientists often need to develop qualitative inferences about inadequately predicted weather extremes based on insights from observations or conceptual understanding. These urgent societal priorities offer grounds for knowledge discovery approaches. The factors responsible for weather change in terms of environmental degradation and subsequently global warming leading subsequent change in agriculture, food production and food security. It also causes the uncertain storm and heavy rainfall which turns into flood. So, in this research work it is preferred to find out the relationship between climate degradation and global warming due environmental pollution and biological wastes through wireless nano sensors network (WNSN) caused by highly congested and uncontrolled development of urbanization to manage the habitant problem of huge population which is the major requirement of growth in developing countries like India.

Keywords

Urbanization, environmental pollution, climate variables changes, global warming, wireless nano sensor, data mining.

1. Introduction

The proposed Data Mining based weather modeling data taken from Wireless Nano-Nano sensors will clearly indicate where the assimilation capacity is still available for further growth of urbanization, energy production, industrialization as well as agriculture, food production and food security. In this case India is taken as a developing country and the final focus will be to determine pattern of development leading to global warming affected by the biological wastes contributed from the developing urban areas and subsequently weather change affecting the human life across the world. This Expedition project will significantly advance data analysis methods necessary for systematically leveraging information in the more credible weather projections to improve projections of the more crucial variables. Recent research, ranging from hurricanes and precipitation extremes to drought patterns, suggests that this may be an achievable target. This research team will develop data driven approaches that take advantage of the wealth of weather and ecosystem data now available from satellite and ground-based nano sensors, observational records for oceanic, atmospheric and terrestrial processes, and physics-based weather model simulations. Weather science will benefit from improvements in less well-understood physical processes, while stakeholders and policy-makers will benefit from predictive insights that are useful for decision makers. The parameter of weather became changed in the parameter of temperature, air density, humidity, vapor carrying capacity, aerosol. Uncontrolled urbanization not only affects the global warming but also it causes the ozone layer depletion. Ozone layer depletion due to the greenhouse gases produced from chattels and biological waste from them.

The greenhouse gases contributed from the Developing Urbanizing Areas which is most growing requirements of habitant in developing countries, plays the major role for the global warming as well as ozone layer depletion. In India there is a large scale of biological wastage oriented activity in a small area with a high value of human density especially in developing urban area. The rate of greenhouse gases emission from cattle is highly concentrated which affects the ozone layer being deployed from many places. So, the harmful ray can enter in our atmosphere which is responsible for the changes of weather elements in our living lives. Collection of data is used for Meteorological knowledge discovery.

The meteorological data are available for about 100 years or more. This indicates rise in temperature, climate change specially the weather affecting agriculture very adversely because in tropical countries including India, the pattern of cultivation depends on weather-rainy season, winter season or summer season. The second part will be application of Data Mining to determine the pattern in agriculture and other related activities.

2. WSN for Climate Monitoring

The Weather Data Mining requires the wide-area infrastructures, remote nano sensors, and wireless nano sensor networks with massive volumes of dynamic and geographically distributed data. As nano sensor technology is becoming ubiquitous, the requirements are also increasing to emerge across the high-priority applications with disaster preparation and hazard management as well as weather change and national security including critical infrastructures [4]. The raw data collected from nano sensors is required to be managed efficiently and extract the actual information through data mining in which the predictive knowledge discovery or strategic policy should be included. The challenges for Knowledge Discovery are vast. Though the dynamic data streams or events claims real-time analysis, the centralized high performance computing is also required for generating the offline predictive which can facilitate the real-time dynamic data stream analysis [5]. The data mining technique is mainly raised not only for detecting the climate impacts on human lives and possible changes in climate variables but also it would be used to prevent terror attacks and monitor the explosive devices through analyzing the anomalies, change in pattern, extremes and nonlinear processes in normal behavior.

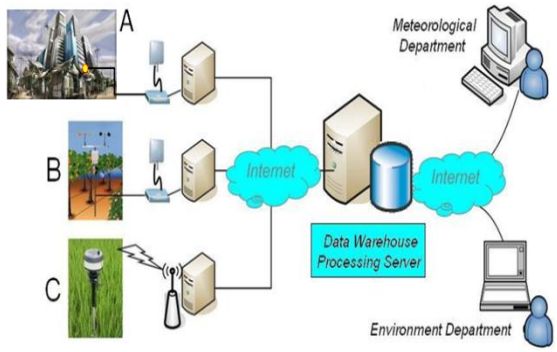

Figure 1. Wireless Sensor nodes for urban as well as climate variables sensing

The approaches of dataset analysis will be suitable for the weather and ecosystem, such as nonlinear processes, non-stationary, long-range spatial dependence, low-frequency variability, multi-scale nature and long-memory temporal processes. These techniques would help to understand the complex pattern of the climate system and the nature of its mechanisms which are the key factors for the weather changes. [7]. A wireless nano sensor network (WNSN) is a communication system which is made of thousands of nano sensor nodes which are deployed in a certain fashion in an unattended environment including the parameters which are capable of sensing, wireless communications and computations like disseminating analysis. These spatially distributed autonomous devices sequentially monitor the physical and environmental conditions such as air pressure, aerosol, moisture, temperature, and dust at different locations. The Cognitive radio networks (CRNs) are combinedly implemented for critical network functions like cooperative sensing and channel assignment. These functions require a broadcasting control channel for localized coordination [2]. For example, nodes may be used as a predefined control channel to negotiate the data transmission as well as reserved the medium for future transmissions. No common channel can be existed due to temporal and spatial deviation of the spectrum availability. Though CRN can sense the different sets of idle channels depending on their relative locations to PRNs, it may not be able to communicate the information over the predefined channel. To cope with the variation of time-space nature of the channel with respect to availability in CRNs, a cluster-based processing for the control channel can be considered in it. To locally assigned control channels in the absence of a current one, a neighbor will start the communication and coordinate the data transmission mechanism suitable for CRNs.

Each autonomic node in a nano sensor network is typically equipped with a radio transceiver or other wireless data communications device, a processing unit or small micro-controller with a particular sensing unit and an energy source such as alkaline battery. Sometimes, a mobilizer is required to move the nano sensor node from current position to carry out the assigned tasks. Since the nano sensor may be mobile in nature, the base station should require the accurate location of the node which is implemented in the location finding system. The size of a single nano sensor node can vary from shoebox-sized to the grain of dust [6]. Data mining technique with its capabilities of multi-category classification is one of

the most emergent technologies for supervising the learning based class separation methodology with maximum margin for any kind of dataset. The Support vector mechanism is used to maximize the separation limit among the given set of classes. Though the clustering technique for climate dataset is originally developed for binary classification, but that could be efficiently extended for multiple class oriented problems. While dealing with multivariate data and number of classes as well as size of datasets are concerned with the two prime objectives which affect the degree of optimization. Four different distinguish techniques are used for multi data warehousing in which the Support Vector Mechanism is the robust one among them [3]. In the following section the proposed technique is described to fulfill these research requirements in details. Finally, this research work can describes the variable parameters which are considered as primary elements for analysis the weather, climate and atmospheric influences such as climate change, pollution and the elements of global warming affected the air density, pressure, aerosol temperature and humidity etc.

3. Transformation of Climate Variables Data

In this technique a recent advancement in nano sensor technology and wireless radio frequency with the capability to measure the changes in weather is described to permit the atmospheric conditions for analyzing the climate changes. The combination between the functionality of GPS (global positioning system) with geo-referenced information system is used to analyze wireless nano sensor networks (WNSN) in real-time scenario for making the decision in precision architecture (PA). In this case, a larger region for the data collection is chosen for monitoring the weather conditions.

In this research work, the remotely located real-time nano sensors associated with hardware devices and suitable software for data collection, logging, and distribution are taken as the primary concern. Data collected by the wireless nano sensors is relayed through a series of repeaters to the base station where the data is manipulated and connected directly to the Internet for transmitting to a storage server. At the final point of data collection and analysis for comparative information matching and synthesis would be done by the data warehousing technique. The data collected from the building models could enhance the understanding about the effects of climate change due to global warming affected by uncontrolled urbanization in the tropical countries especially in India. For the changes in the solar activity, many elements in which we are directly dependent for our live hood became change itself. Directed diffusion, most effective data aggregation protocol [5], is taken as the primary transmission protocol to communicate the data to the main data server. It is a data-centric based application routing protocol for Wireless Nano sensor Networks. Directed diffusion consists of several elements. The naming task describes the sent out data by sink or received data by assigning attribute-value pairs. Secondly the description constitutes an interest that contains the timestamp field and several sub-gradient fields. Each leaf and intermediate nodes store the information in their cache. If the information propagates throughout the wireless network, the gradients from the source to sink will be set up. Thirdly in data propagation when the source node has information for the interested node, it transmits the data to it (i.e., sink) along with the gradient path of the interested node which can be chosen as either the shortest path or the shortest time-path from the request packet. Fourthly, if the sink starts receiving low rate data, it can reinforce its particular neighbor to draw higher quality data rate. The feature of directed diffusion is achieved by local data-driven rules. Directed diffusion can save the energy of nano sensors by selecting the better paths by caching and processing information through the network since each node has the capability manage data caching and aggregation. The Directed diffusion has limitations such as; implementing data aggregation demands deployment of techniques synchronization. The overhead data aggregation involves recorded information as shown in the figure below:

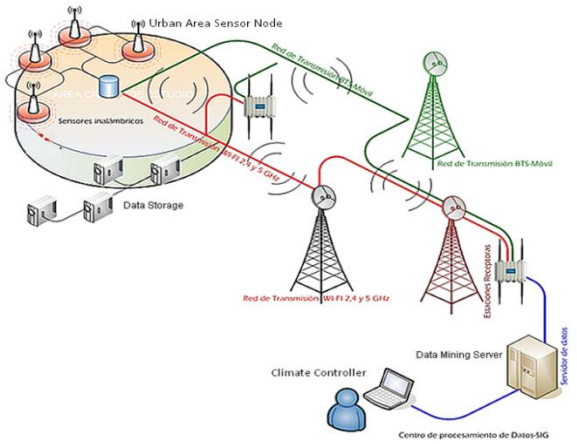

Figure 2. Data communication through WNSN to Data Mining Server about Climate Variables

These drawbacks may increase the cost of nano sensor node for performing in Directed diffusion technique which can be propagated in some of the autonomic wireless nano sensor networks.

Automatic Network Architecture (ANA), considered as the primary framework for the wireless network communication, is built on the method providing an architectural framework that allows the communication between various networks [7]. The development from small scale Personal Area Networks to global scale networks is originated by the Ad hoc and special purpose networks such as Nano sensor Networks. ANA introduces the fundamental idea of network compartments methodology. The abstraction of the networking compartment allows the automatic and decomposed communication network systems into smaller and easier units [9]. For example, compartments could decompose the global IP network into proper sub-networks which can be efficiently managed from the overall wireless network. In a wireless network compartments the administrative policies and operational rules for a given communication context can be implemented. The compartments typically perform the functions like policy enforcement, registration and degradation, identifier management and Routing. There is no necessity to deploy any unique path to resolve identification and manage the universal addressing scheme. It is an open addressing scheme since urbanization is not mobilized in nature.

4. Data Mining Technique for Relationship Building

To realize this ambitious goal, novel methodologies appropriate to weather change science will be developed in four broad areas of large scale data analysis:

- Predictive modeling
- Relationship mining,
- Ubiquitous Data Mining
- Dynamic Data processing and high performance computing.

The implementation of data warehouse technique as a schematic high-level architecture will help to map the relationship between urban environmental pollution data and climate changing parameters. This technique would be different for ordinary implementation methods, but the utility and advantage of this technique of data warehousing does not depend how well the climate data model indicates the type of processing [4]. The data warehouse modeling for hierarchical and multidimensional knowledge building from the global warming variables can be considered as the perspective of climate changes. A carefully designed data mining relationship between climate changes due to global warming and environmental degradation in developing urban areas must be kept in the database management system which should be efficient enough to manage the huge amount of dynamic data into terabytes to find the match between these parameters.

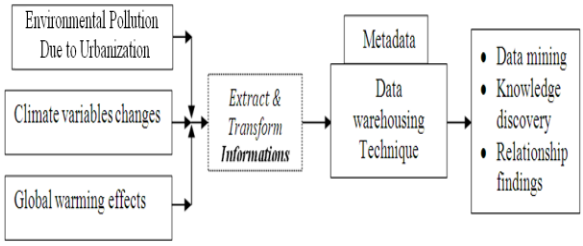

Figure 3. Flow of data in data mining technique to discover the knowledge gap

The process of extracting unknown information from the repository of historical and old data, known as data warehouse, of climate parameters using multivariate statistical and advanced artificial intelligence techniques will help to discover the possible changes in climate variables affected by the global warming. Data mining claims a perspective exploration that constantly guides the mining operations. To get the optimized result from data mining process, only home-grown data is not sufficient; the outsourced data is also needed to be added including the parameters of geographical information, demographics, economic and social indicators, weather and climate patterns etc. Data mining technique for climate database is an independent process that is used to invent new facts and uncover new relationships which are previously unknown even the experts thoroughly familiar with the dataset [8]. The data mining process of climate variables, global warming details and environmental pollution from urban locations are diagrammatically exemplified in figure below:

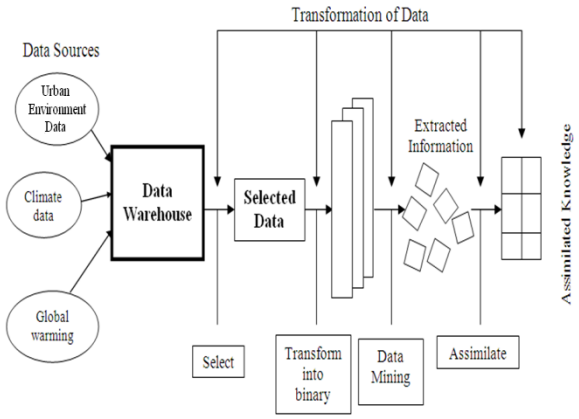

Figure 4. The Data mining Technique is used to match the features between climate and urbanization

The changes in climate atmosphere caused by environmental degradation due to uncontrolled urbanization and global warming effect as well as the evaporation factors from the sea surface and water areas what changes the margin of humidity and moisture in the air. This simulated result will indicate the relationship between the possible changes on weather parameters caused by the global warming and environmental degradation due to uncontrolled urbanization and its pollution.

5. Simulated Result of WSN in QualNet

The proposed wireless nano sensor network based data mining technique for monitoring environmental degradation due to uncontrolled urbanization in India has been deployed in QualNet simulator. This network design tool helps to map the tentative data communication process from each wireless nano sensor nodes to central data server. In the central data server the data mining technique can be applied to discover the relationship between pollution and environmental effects due to urban developments. The wireless network architecture implemented in QualNet for data transmission from wireless nodes to server is shown below:

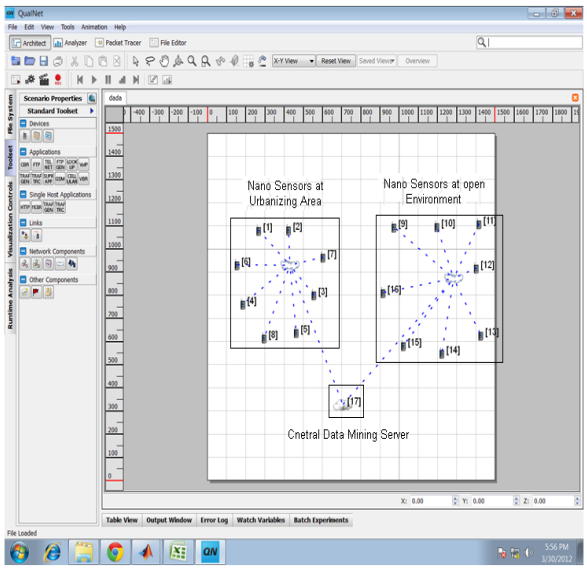

Figure 5. Virtual Installation of WNSN at Urban and Climate Zone in QualNet

In the above image two sets of wireless nano sensor network clouds are defined. The first group of nano sensor networking nodes is deployed in the urban area to collect the pollution data like CO2, GHG emission rate, chemical compounds in dust etc. which is entitled as “nano sensor in urbanizing area” in the image. And the 2nd group of nano sensor networking nodes is implemented in open climate region to collect the data of climate variables such as temperature, rainfall frequency, fog etc. The 2nd group of nano sensor network is entitled as “nano sensor at open environment” in the image. Each group is connected to the central data server through wireless network which is shown as “Central data mining server” in the figure above. Each nano sensor node is linked to sub-server in their group, known as sink node, from where the parameters are sent to the server for further processing. The simulated result of data communication has been shown in the image below:

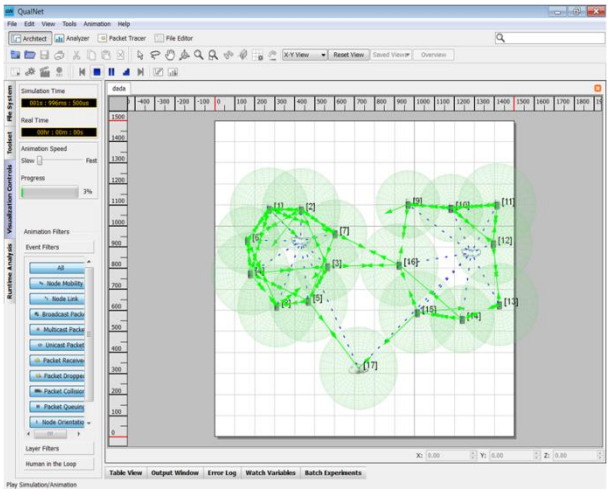

Figure 6. Communicating of data between WNSN simulated in QualNet

6. Simulated Result of Data Mining in WEKA

The For the proposed wireless nano sensor network based data mining technique is deployed on the dataset of urban development taken from http://esa.un.org/unpd/wup/CD-ROM/WUP2011-F01-Total_Urban_Rural.xls combined with the data of pollution and climate variables collected through the wireless nano sensor nodes installed in the urban area. This technique will help to find out the relationship between urbanization and climate changes due to pollution. The uncontrolled urbanization is one of the major problem for environmental pollution because of deforestation, improper usages of lands, poor garbage disposal system etc. So, findings the similarities in the parameters of environmental degradation as well as increasing of pollution due to urbanization which is a major requirement for developing countries especially in India where 74% of population still living in rural and semi urban areas, is taken as the primary concern in this research. In the taken dataset of urbanization, combined with the data of pollution and climate parameters, the following variables have been hybridized with each other for data mining processing shown below as column wise:

- 1st column : Percentage of urban population
- 2nd column : urban population in thousand
- 3rd column : rate of change in urban population
- 4th column : percentage of change of population
- 5th column : Total Fossil-Fuel emission
- 6th column : Emissions from Liquid Fuels
- 7th column : Emissions from Solid Fuels
- 8th column : Per Capita Emission Rate
- 9th column : average temperature in °C

The artificially combined dataset of pollution, urbanization and environmental variables is deployed on WEKA simulator to discover the relationship between urbanization and temperature increment which is known as global warming. The recognition of similarities among the parameters between climate degradation and pollution due to uncontrolled urbanization is represented in graphical form below:

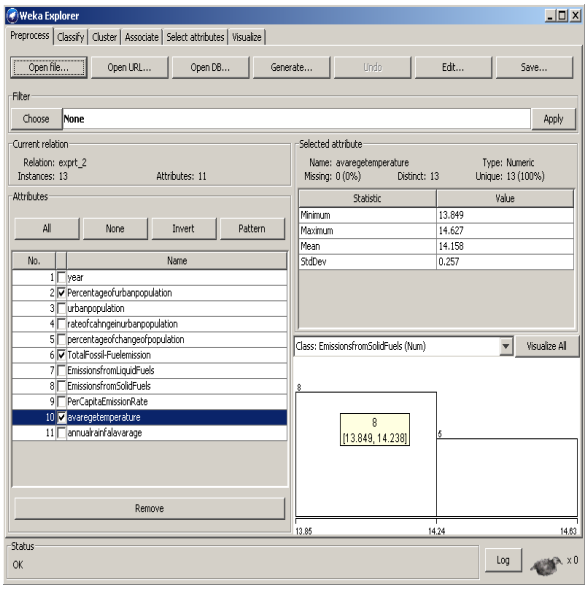

Figure 7. Climate variables mining for urbanization simulated in WEKA

In the resulted image, the number 8 is the highest rate of change of temperature due to rate of change of urban population and total fuel emission as 13.849 and 14.238 respectively. The uncontrolled fuel burning is the key factor for global warming which is increasing because of the demand of urban developments. The relationship between the fuel emission and rate of change of urban population with respect to the increment of global temperature is simulated on WEKA to discover their interlinked patterns in India scenario. The respective result developed through WEKA for discovering the hidden

knowledge in the manipulated dataset is shown below:

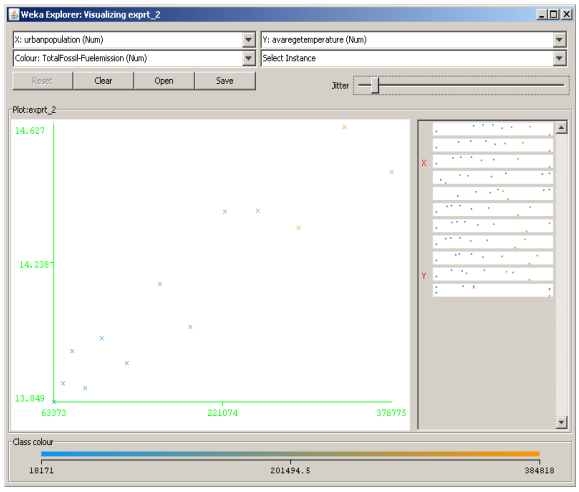

Figure 8. Climate variables mining for urbanization simulated in WEKA

In the above image X axis represents the increment of urban population and the Y axis represent the temperature scale. The rate of change of fuel emission is denoted by the color scale at the below position of the graph above. From the above figure it has been clearly concluded that the increment of global temperature is directly parallel to the increment of fuel emission rate because of requirement of consumption of fuel is raised due to uncontrolled urban developments in India.

7. Conclusion

The Assessments of weather change impacts, which are useful for stakeholders and policymakers, depend critically on regional and decadal scale projections of weather extremes. Thus, weather scientists often need to develop qualitative inferences about inadequately predicted weather extremes based on insights from observations (e.g., increases in hurricane intensity) or conceptual understanding (e.g., relation of wildfires to regional warming or drying and hurricanes to sea surface temperatures). These urgent societal priorities offer fertile grounds for knowledge discovery approaches. In particular, qualitative inferences on weather extremes and impacts may be transformed into quantitative predictive insights based on a combination of hypothesis-guided data mining, data analysis and relatively data warehoused hypothesis-free, yet data-guided discovery processes.

Acknowledgments

We thank to our Honorable Director Sir for allowing us to perform this research work by providing excellent academic facility under his privilege guidance.

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