

Cloud for Pollution Control and Global Warming

Nitin B Raut, Jabar H. Yousif, Sanad Al Maskari, and Dinesh Kumar Saini

Abstract— the objective of this paper is to conduct research on an area related to pollution control and cloud computing. Role of cloud computing in global warming, Green house Effects and pollution control. Independent monitoring, control and prevention of pollution is very important for protection of health and survival of human being. Pollution control is costly affair and managing the pollution need customized and specialized solutions so it is analyzed and suggested that cloud can help in this case.

Index Terms— Clouding Computing, Air pollution, Water pollution, Sound pollution, Soil Pollution, Green House Effects, Global Warming etc.

I. INTRODUCTION

The rapid development of the digital world based on sophisticated instruments such as computer, satellite, telecommunication instruments has revolutionized the human lifecycle. The use of information technology in environmental prevention and control has proved to be cost effective and more reliable. Pollution-cloud provides all tool and analysis technologies on demand basis to all whenever nation or people desire.

The Greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere. It results from certain atmospheric gases, such as CO₂, water vapor, and methane, are able to change the energy balance of the planet by absorbing long wave radiation emitted from the Earth's surface. Without the greenhouse effect life on this planet would probably not exist as the average temperature of the Earth would be a chilly -18° Celsius, rather than the present 15° Celsius [11].

Global warming is when the earth heats up means temperature rises. It happens when greenhouse gases (carbon dioxide, water vapor, nitrous oxide, and methane) trap heat and light from the sun in the earth's atmosphere, which increases the temperature. This hurts many people, animals, and plants. Many cannot take the change, so they die [12].

Pollution is the beginning of a waste into the atmosphere making it impossible to make life on earth possible to sustain [13]. Water pollution is the introduction of chemical, biological and physical matter into large bodies of water that

corrupt the quality of life that lives in it and consumes it [13].

Water pollution has become a source of human disease, in the word, 80% of disease and 50% of child deaths are related to contaminate drinking water according to reports from WHO [3]. Air pollution one or more chemicals or substances in high enough concentrations in the air to harm humans, animals, vegetation, and materials. It has caused thinning of the defensive ozone layer of the atmosphere, which is most important to climate change.

Electromagnetic Radiation Pollution creates health problem in modern society by Electronic Products and Electrical appliances (such as TV, radio stations, radar, satellite, mobile communications and microwave transit stations). Impact on people's due to radiation on cardiovascular system, manifested as palpitations, insomnia and Women's menstrual disorder, leukemia etc [7].

Radio Active Pollution is due to, Disposal of Nuclear waste, uranium mining, Nuclear Weapon, Laser rays etc. This pollution creates Ulcer, Cough, Cancer (Skin, Lungs, Bone), swelling of bone joints and eye problems etc. **Soil Pollution** is due to urbanization and industrial development in the last centuries, which posed great health hazards to humans and other life forms turns to be, solved crucially [14].

II. CYBER INFRASTRUCTURE FRAMEWORK FOR POLLUTION

Information technology sophistication is emerging in all fields of engineering. The pollution control systems are also one of the domains where cyber infrastructure has very big impact factor, like in designing pollution control systems, or either handling industrial waste management. In pollution control systems information processing, filtering and knowledge disseminations are some of the aspects which must be designed properly with Multi-Agent Systems [1,2] can be used in smart monitoring simulators and intelligent systems to perform several tasks like data filtering and alarming systems. Agents have to react to events, define strategies, interact, and participate in the activities of the system. Internet is also busting use for such agent based systems.

III. NEED FOR POLLUTION CONTROL STRATEGIES

The cost of treating and controlling pollutants be it solid, liquid or gas is enormous and it may seem to the industry to be nonprofit bale. In such scenario the controlling measure are moral. However, the present day there are strict regulation for pollution prevention and control. The control and prevention measure are costly and apart from monetary investment there is investment of manpower and machinery. This makes it more so difficult. Though, prevention and

Nitin B Raut is with Sohar University, Sohar, Sultanate of Oman (nitin@soharuni.edu.om)
Jabar H Yousif is with Sohar University, Sohar, Sultanate of Oman (jyousif@soharuni.edu.om)
Dinesh Kumar Saini is with Sohar University, Sohar, Sultanate of Oman (dinesh@soharuni.edu.om)
Sanad Al Maskari is with Sohar University, Sohar, Sultanate of Oman (sanad@soharuni.edu.om)
Ganesh B Shinde is with SVIT, Nasik, Maharashtra, India (gbs18nasik@gmail.com)

treatment can be more attractive by converting the waste or pollutants into useful products so that the waste/pollutant ceases to exist. Technology this aspect is limited due to the varied source and nature of pollutants.

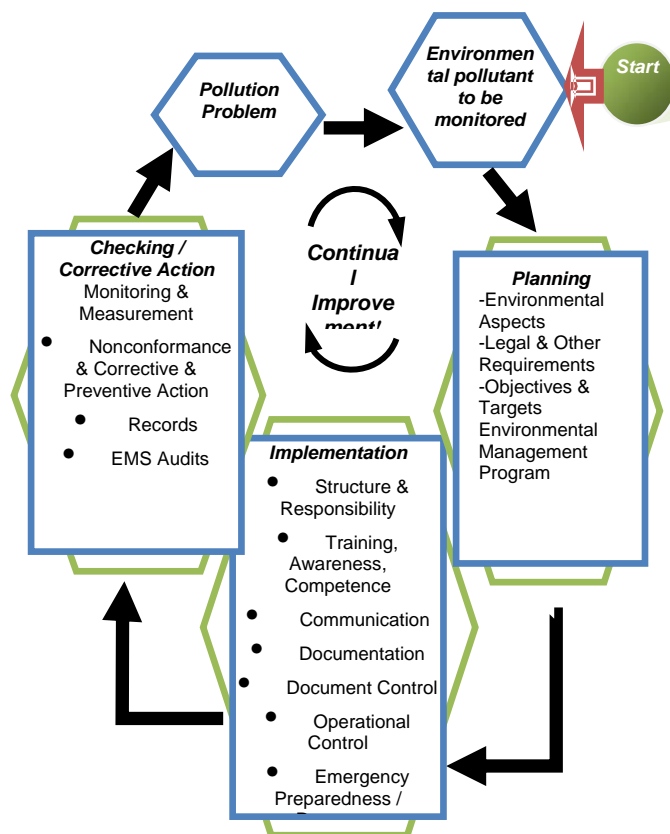


Fig.1 Environmental Pollution Control

More often when environmental regulations are enforced there is an enormous debate over the actual cost of the control equipment and their positive effects to the society and environment. The exact cost of the control equipment and technology needs to be carefully evaluated so as to have a clear and precise picture of the advantages to the environment to make it economically viable.

Technology transfer economics and affordability of the treatment and prevention technology calls for better collaboration and understanding between the industrial and environmental consultancy. This can be based on a technology sharing basis or on a prepaid basis. This will bring all the industrial, environmentalist and specialists on a common platform as pollution prevention and abatement has now grown up to a global issue. However, the coordination and collaboration has to be framed carefully so that the economic interest of industries, environmentalist and specialist are harnessed. This may require out of the box thinking which undoubtedly requires a global and humanitarian perspective.

IV. COST OF POLLUTION CONTROL

Pollution control and prevention measure involves investment which is normally looked upon to be a non-profit generating capacity by the industrial organizations. The two cost categories that mainly account in the economics of a pollution control measure is the capital cost and the operation and maintenance cost. The initial capital

cost mainly comprises of the following functions and cost sections

A. Total Capital

1. Planning and Permitting
2. Equipment Design, Selection and Engineering
3. Equipment Fabrication, Construction and Installation
4. Equipment and Process Facility Integration
5. Training, Start-up, Testing, Monitoring and Reporting

B. Operation and Maintenance

Though an art computing the total cost for a pollution control strategy to meet environmental regulations has to be based on scientific and engineering principles. However the process is time consuming, economically stressful and includes cost factors which may not necessarily be accounted for while preparing the cost estimates.

Contradictory to this the regulations are framed based on the best information available to predict the effect of these regulations on the regulated society and environment. Such information may often include only the equipment cost and neglect the associated cost that forms a major amount of the total cost. Many a times the cost data is extrapolated from data's for independent and differing facilities.

V. INFORMATION TECHNOLOGY AND POLLUTION CONTROL

Information technology can play a vital role in pollution control and prevention. The modeling and simulations of the pollutants can be very useful during the design and implementation of pollution control and prevention projects. The information technology based services are a handy tool for predicting, preventing and controlling pollutants.

The Remote sensing and Geographical Information System (GIS) has been effectively used in environment management. These techniques can sense and predict the ongoing changes in the environment through satellites by remote sensing systems. The information obtained can be used to avoid loss and damage of human life and property during natural calamities like droughts, floods, volcanic eruptions etc., can also be predicted well in advance. The assessment helps in planning disaster management program and hence minimizes the effect of these natural events. Such systems provide a network database in environmental issues like pollution control, renewable energy, desertification, biodiversity etc.

In the pollution control systems there is one concern which affects the industries is that most of the pollutant and pollutant sources are of diverse nature. Hence the treatment and control of these pollutants needs specialized and costly equipment to be controlled within permissible limits. The solution required is also requiring very specific solution so designing such systems for each industry is costly affair.

The concept of cloud computing is cost effective and can aid in improving environment on a global perspective.

Computerized database can be retrieved as and when required and can be maintained more accurately than before in computers. Efforts are undertaken around the globe to compile a database on various environmental issues like wildlife, forests cover, wasteland etc.

The concept of cloud computing refers to the applications, the hardware and software delivered as

services over the Internet [4] [1] can be more advantages in most of the concentrated industrial zones. Pollution-Cloud delivers Pollution control services by cloud to nations and people of world whenever they are required.

This will not only improve analytical reliability and management of environmental pollution but will also present an ample opportunity to concentrate on upgrading treatment technology. This will provide ample opportunities to individual industries to reduce their capital investment on pollution related issues and make the treatment economical and more attractive. This will enhance the rate of information exchange between the industry and government agencies and hence be decisive in framing energy and environmental policies and regulations. It will definitely promote technically sound, promote technically sound, reasonable and cost-effective laws control techniques and measures and regulations; pick up environmental performance, consistency and cost efficiency of the of group operations through technical transaction and sponsorship.

VI. OVERVIEW OF POLLUTION –CLOUD

Software industry is also contributing for the solutions of the complex problems so various companies are offering different software solutions for the various real time problems like pollution and waste management. Companies can share the knowledge and expertise through cloud.



Fig.3 Companies offering specialized cloud solutions

Pollution cloud is very important for any nation and society for managing and controlling polluted Environment and developing Eco-friendly systems.

Pollution-cloud provides all organizational and management activity of pollution control by cloud computing for society. Pollution-cloud also provides alarming services on iPhone (Thin client) for Global warming and Green House Effects for coming future by data mining.

A. Architecture of Pollution-Cloud

As in given diagram client work on browser based devices and cloud works as back hand which have various distributed server for different services such as storage

(infrastructure as a service), which is provided by many data centers. PaaS will provide run time environment for hosting and managing POLLUTION cloud services which includes execution monitoring and management, Dynamic SLA management, Accounting etc.[2][5].

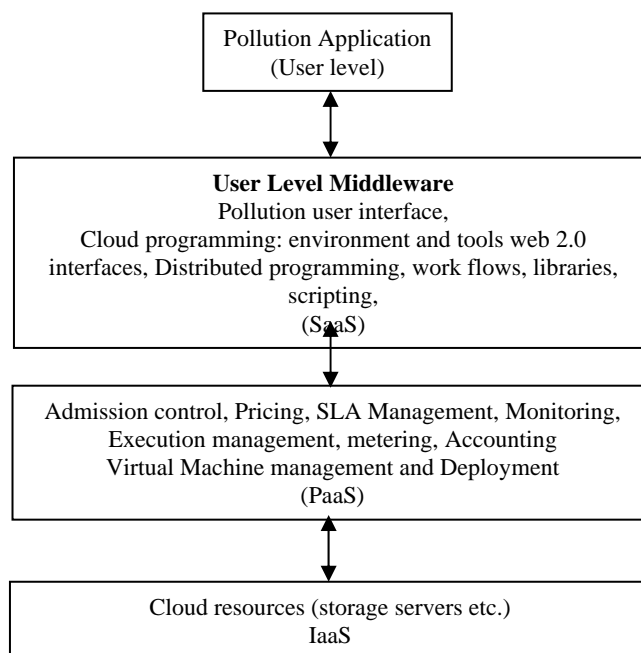


Fig. 4 Cloud Technologies

POLLUTION cloud application is running on SaaS layer which is User Level Middleware as shown in diagram [6]. In this layer Pollution cloud application are directly available to end user.

Intelligent Data Collector device collects data from various pollution measuring devices which are installed in different cities if they found above limits than data is transferred to cloud using thin client, ultimately all data are transferred to cloud in online mode. Automatic Pollution measuring devices are installed at various point pollution (black listed areas) areas.

Hospital data are uploaded on Pollution cloud using online hospital management system from different cities.

Here warehouse is developed for various distributed databases and mining done using prediction and association algorithms. Associations are established for finding various effects of global warming and green House effects. Warehouse contains various data related to disease developed of last year's where we have taken pollution data.

Results from data mining are checked from last effects and calibrated for further use in pollution control and E-Governances by interfacing Cloud for E-Governance.

Here no involvement of manpower in data collection so corruption is totally removed. All devices are automatically taking reading so we get actual data for air, water, sound pollution and global warming effects. Pollution-Cloud provides all facility to environmentalist and industry for data storage, managing and analysis on demand basis even to access super computer level computing power [8].

VII. . ADVANTAGES OF POLLUTION CLOUD

a. World level environmental study and control without any human inference.

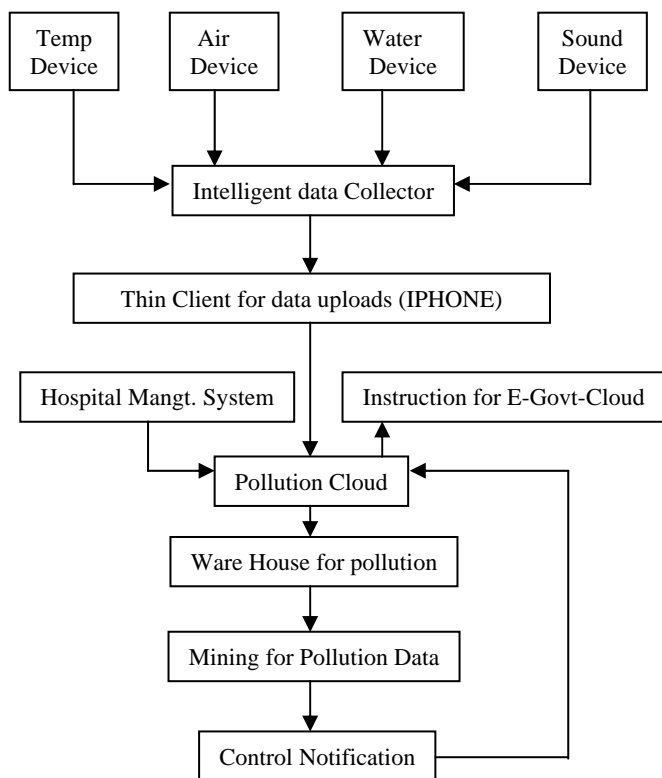


Fig. 5 Data Flow of Pollution Cloud

b. Actual data reading, monitoring and analysis without any corruption.

c. All advance tool are available for environmental analysis on demand or whenever required.

d. Future forecasting of coming environment (pollution) and their control.

e. Data mining for pollution effects and diseases association in localized form.

f. E-governance and providing NOC to different industry.

g. Locate area for pollution source control projects for prevention [10].

h. River Supervision and water quality control are done by Pollution-Cloud.

i. Resource planning (water, land etc.) for short and long term project easy with forecasting.

j. Pollution-cloud helps in Hazardous wastes management and polices making.

k. Protection of water resources is very important that is done by Pollution-cloud [14].

VIII. CONCLUSION

In the paper it is found that pollution is a big problem and handling this problem require lot of money, skill and talent. Pollution solutions have very specific requirements and the services needed are much customized so the industries and organizations need some kind of solution like cloud which can provide the required services. Cloud computing is the solution which can help the companies and organizations to reduce the cost in handling pollution as well as it will help the companies in carrying out their corporate social

responsibility. In coming future applications on pollution-cloud play major role because of scaling, on demand services and working on mobile devices (thin client support). Nations and People will get benefit from Pollution-cloud and help for Eco- friendly working and pollution free environments.

REFERENCES

- [1] Brizgalov, Chukhantsev, Fedorkin, "Architecture of Traffic Control System Using Cloud Computing", 10 International Conference and Seminar EDM '2010, July ERLAGOL, pp 215-216.
- [2] Chen Qibin, Fan Guisheng, "Comprehensive treatment plan for typical integrated utilizing reservoir: a case study of Zhangze Reservoir, China", International Conference on Digital Manufacturing and Automation, 2010 IEEE, pp 415-417.
- [3] Chieu, Mohindar, Karve and Segal, "Dynamic Sacing of Web Applications in a Virtualized Cloud Computing Environment ", IEEE International Conference on E-Business Engineering, 2009 IEEE ,pp. 281-286
- [4] http://library.thinkquest.org/CR0215471/global_warming.htm dated 31 JAN 2011.
- [5] <http://www.physicalgeography.net/fundamental/7h.html> dated 31 Jan,2011
- [6] <http://www.pollution.in/> 31 Jan, 2011.
- [7] Rodrigo, Ranjan, Anton, Rose, Buyya, "CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms", June 2010, Jon Wiley and sons.
- [8] Shuai Zhang, Shfen Zhang, Xuebin Chen, Xiuzhen Huo, "Cloud Computing Research and Development Trends", 2010 Second International Conference on Future Networks, 2010 IEEE, pp 93-97.
- [9] Tian Jinghuan, Wang Yi, "A Novel Water Pollution Monitoring Approach based on 3s Technique", 2010 International Conference on E Health Networking, Digital Ecosystem and Technologies, 2010 IEEE, pp 288-290.
- [10] Vecchiola, Pandey, Buyya, "High Performance Cloud Computing: A View of Scientific Applications", 10th International Symposium on Pervasive System, Algorithms and Networks, 2009 IEEE, pp 4-16.
- [11] Wang Minghu, Gao Zhenji, Xu, Haiming, "An Information Grid-based Model for Sharing Water Pollution Control and Prevention Technologies", 2010 IEEE, pp 314-317.
- [12] Yang, Wei, Jia, Cong, Shan, "A Cloud Architecture Based on Smart Home", 2010 2nd International workshop on Education Technology and Computer Science, 2010 IEEE, pp 440-443.
- [13] Yao Ling, "Sampling and Coding of Soil Environmental Quality Data for Pollution Control", International Conference on Computer Application and System Modeling (ICASM 2010), pp 160-161.
- [14] Zhong-feng, Ji-juan, Qing-zhi, "Study on Pollution Control Measures of Electromagnetic Radiation Based on Ideas of Energy saving", 2010 IEEE.