ISSN 2395-1621

Integrated System for Regional Environmental Monitoring and Management based on Internet of Things

[#1]Sushant Bansode, [#2]Akash Jadhav, [#3]Prashant Kachare, [#4]Rahul Pawar

[4]rahulpawar52503@gmail.com

[#1234]Department of Information Technology

AISSMS Institute of Information Technology, Pune.

ABSTRACT

Climate change and environmental monitoring and management have received much attention recently, and an integrated information system (IIS) is considered highly valuable. We introduces a novel IIS that combines Internet of Things (IoT), Cloud Computing, Geo-informatics [remote sensing (RS), geographical information system (GIS), and global positioning system (GPS)], and e-Science for environmental monitoring and management, with a case study on regional climate change and its ecological effects. Multi-sensors and web services were used to collect data and other information for the perception layer; both public networks and private networks were used to access and transport mass data and other information in the network layer. Field information service (IIS) acquires various environmental data such as air temperature, wind speed, wind direction, precipitation, river water and water quality, then provides the data in various protocol. We provides a prototype IIS for environmental monitoring and management, and it also provides a new paradigm for the future research and practice; especially in the era of big data and IoT. We describe measurement system for climate change and environmental monitoring and management.

Keywords: **Climent change, Data mining, Environmental monitoring and management, Internet of things.**

ARTICLE INFO

Article History

Received: 22nd May 2016

Received in revised form :

22nd May 2016

Accepted: 24th May 2016

Published online :

26th May 2016

I. INTRODUCTION

Environmental informatics has experienced a very rapid development and wide application in monitoring, modelling, and managing environmental processes. Environmental informatics involves specific environmental problems related to the applications of computer science and systems engineering techniques, management information system (MIS), and environmental information system (EIS), which were designed to collect, process, and exchange data and information. Automatic data acquisition has been accelerated by a variety of technologies, such as remote sensing (RS), geographical information system (GIS), global positioning system (GPS), and so on. From the proliferation of automatic data acquisition technologies, such as radio frequency identification (RFID) and sensor technologies, was introduced to create decision support systems (DSSs) and integrated environmental information systems (IEISs), and also brought new vitality to environmental monitoring and management.

II. LITERATURE SURVEY

1 .N. Niu, L. Xu, and Z. Bi, "Enterprise information systems architectureanalysis and evaluation,".2013

Numerous software architecture proposals are available to industrial information engineers in developing their enterprise information systems. While those proposals and corresponding methodologies are helpful to engineers in determining appropriate architecture, the systematic methods for the evaluation of software architecture are scarce. To select appropriate software architecture from various alternatives appropriately, a scenario-based method has been proposed to assess how software architecture affects the fulfilment of business requirements.

2. .M. Haklay, From Environmental Information Systems to Environmental Informatics: Evolution and Meaning. London, 1999

The empirical evaluation on the selection of a supply chain software tool has shown that the developed method offers remarkable insights of software development and can be incorporated into the industrial informatics practice of an organization with a moderate cost.

3. L. Xu, Z. Li, S. Li, and F. Tang, "A decision support system for product design in concurrent engineering", 2007

Environmental informatics is an interdisciplinary field involving environmental science, Computer science, information science, and industrial information integration engineering (IIIE). It formally started developing in the early 1990s in Europe to integrate and coordinate various informatics technologies and facilitate decision-making to intimately link the territory knowledge with expected social, economic, ecological, and environmental objectives. DSS is the spectrum of the environmental information.

4. H. Reuter, U. Middelhoff, F. Graef, R. Verhoeven, T. Batz, M. Weis, and B. Breckling, "Information system for monitoring environmental impacts of genetically modified organisms,",2010

European legislation stipulates that genetically modified organisms (GMO) have to be monitored to identify potential adverse environmental effects. A wealth of different types of monitoring data from various sources including existing environmental monitoring programs is expected to accumulate. This requires an information system to efficiently structure, process and evaluate the monitoring data.

5. N. P. Melville, "Information systems innovation for environmental sustainability", 2010

Human life is dependent upon the natural environment, which, most would agree, is rapidly degrading. Business enterprises are a dominant form of social organization and contribute to the worsening, and enhancement, of the natural environment. Scholars in the administrative sciences examine questions spanning organizations and the natural environment but have largely omitted the information systems perspective. We develop a research agenda on information systems innovation for environmental sustainability that demonstrates the critical role that IS can play in shaping beliefs about the environment, in enabling and transforming sustainable processes and practices in organizations, and in improving environmental and economic performance.

6. L. Xu, "Information architecture for supply chain quality management", 2011

Studies on environmental sustainability incorporating the information systems have been initiated for improving environmental and economic performance. Because of the continuously growing elderly population and annually declining birth rate, the population structure faces major changes, creating problems regarding medical care and healthcare. To address these problems, this study proposes a tele-homecare system that combines wireless sensors and transmission technologies to provide simple physiological data analysis and remote health management consultation services. This system collects measured data, including heart rate, blood oxygen level, blood pressure, and electrocardiograph results from various physiological measuring instruments using Bluetooth wireless technology to transmit and save these data via the Internet to a remote database.

III. METHODOLOGY

1. Environmental monitoring and managem

Environmental issues such as climate change have received much attention in recent years, and environmental monitoring, modeling, and management enable us to gain a deeper understanding of natural environmental processes. Environmental monitoring and management is a broad area focusing on using scientific and engineering principles to improve environmental conditions**.**

2. Internet of Things (IoT)

The IoT refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. The term "Internet of Things" was first used by Kevin Ashton in 1999, and became popular through the Auto-ID Center and related market analysis publications. RFID tags, sensors, actuators, and mobile phones are often seen as prerequisites for the IoT. Key technologies of IoT include RFID technology, sensor network and detection technology, Internet technology, intelligent computing technology, and so on.

3. Data Mining

Knowledge discovery (KDD) is a process of unveiling hidden knowledge and insights from a large volume of data, which involves data mining as its core and the most challenging and interesting step (while other steps are also indispensable). Typically, data mining uncovers interesting patterns and relationships hidden in a large volume of raw data, and the results tapped out may help make valuable predictions or future observations in the real world.

4. **Sensors Kit**

An Environmental Sensor Network comprises an array of sensor nodes and a communications system which allows their data to reach a server. The sensor nodes gather data autonomously and a data network is usually used to pass data to one or more base stations, which forward it to a Sensor Network Server.

IV. PROPOSED SYSTEM

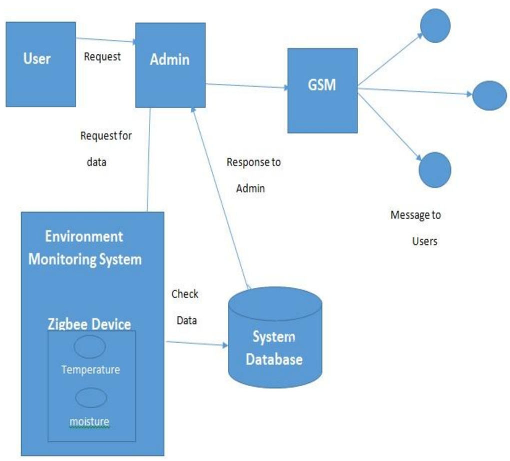


Fig 1. System Architecture

V. WORKING OF PROPOSED SYSTEM

There are different components of proposed system as shown in figure:

1. Admin:
It is the main entity of the proposed system. Admin takes successful registration of user by getting users requirement and store users information in database. By using user's authentic information, admin send monitored data to the user.

2. User:
User is an end entity of proposed system which uses the environmental monitoring system. User first registers for required data to the system. Admin registers the user with its authentic information. As per user need data is sent to user through message or mail.

3. Sensor Node Kit:
Proposed system monitors environmental data through sensor nodes which are mounted on Kit. Kit contains two types of sensors temperature and moisture. Nodes monitors environmental factors and store that information in the database.

4. System Database:
It is the database of the system where monitored data gets stored, whatever data is monitored by temperature and moisture nodes is stored on system database. Admin have control over the database. System database also contains user information of the system.

5. Server
It admin request the server to send the message. It sends the data to authentic user as per its requirement.

6. Environmental Monitoring System (EMS):
It plays major role in the proposed system.it is combination of Zigbee device and the sensors nodes which monitors the environmental factors such as temperature ,moisture, and humidity. After monitoring data it stored in the system database.

7. Cloud Database:
Cloud database is also system database which is acts as temporary storage for proposed system. The data which user need is first fetched on cloud database then it make available to the end user.

8. GSM (Global System for Mobile Communication):
In proposed system data is send to end user through message. For that communication between end user and proposed system GSM is necessary.

VI. ALGORITHM

NAÏVE BAYES ALGORITHM

The Bayesian Classification represents a supervised learning method as well as a statistical method for classification. Assumes an underlying probabilistic model and it allows us to capture uncertainty about the model in a principled way by determining probabilities of the outcomes. It can solve diagnostic and predictive problems. This Classification is named after Thomas Bayes (1702-1761), who proposed the Bayes Theorem. Bayesian classification provides practical learning algorithms and prior knowledge and observed data can be combined. Bayesian Classification provides a useful perspective for understanding and evaluating many learning algorithms. It calculates explicit probabilities for hypothesis and it is robust to noise in input data.

Uses of Naive Bayes classification:

1. Naive Bayes text classification: The Bayesian classification is used as a probabilistic learning method (Naive Bayes text classification). Naive Bayes classifiers are among the most successful known algorithms for learning to classify text documents.

2. Spam filtering: Spam filtering is the best known use of Naive Bayesian text classification. It makes use of a naive Bayes classifier to identify spam e-mail. Bayesian spam filtering has become a popular mechanism to distinguish illegitimate spam email from legitimate email (sometimes called "ham" or "bacn") Many modern mail clients implement Bayesian spam filtering. Users can also install separate email filtering programs. Server-side email filters, such as DSPAM, SpamAssassin, SpamBayes, Bogofilter and ASSP, make use of Bayesian spam filtering techniques, and the functionality is sometimes embedded within mail server software itself.

3. Hybrid Recommender System: Using Naive Bayes Classifier and Collaborative Filtering Recommender Systems apply machine learning and data mining techniques for filtering unseen information and can predict whether a user would like a given resource. It is proposed a unique switching hybrid recommendation approach by combining a Naive Bayes classification approach with the collaborative filtering. Experimental results on two different data sets, show that the proposed algorithm is scalable and provide better performance–in terms of accuracy and coverage–than other algorithms while at the same time eliminates some recorded problems with the recommender systems.

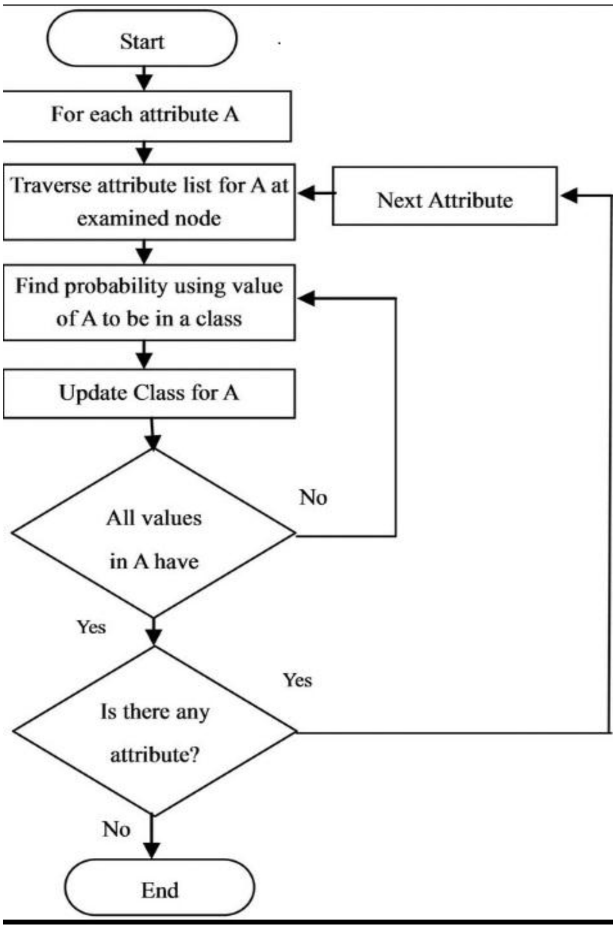
4. Online applications: This online application has been set up as a simple example of supervised machine learning and affective computing. Using a training set of examples which reflect nice, nasty or neutral sentiments, we're training Ditto to distinguish between them. Simple Emotion Modelling, combines a statistically based classifier with a dynamical model. The Naive Bayes classifier employs single words and word pairs as features. It allocates user utterances into nice, nasty and neutral classes, labelled +1, -1 and 0 respectively. This numerical output drives a simple first-order dynamical system, whose state represents the simulated emotional state of the experiment's personification, Ditto the donkey.

NaïveBayes in continuous input:

In the case of continuous inputs Xi, we can of course continue to use equations and as the basis for designing a Naïve Bayes classifier. However, when the Xi are continuous we must choose some other way to represent the distributions P(Xi|Y). One common approach is to assume that for each possible discrete value y k of Y, the distribution of each continuous Xi is Gaussian, and is defined by a mean and standard deviation specific to Xi and yk. In order to train such a Naive Bayes classifier we must therefore estimate the mean and standard deviation of each of these Gaussians: $\mu_{ik} = E[X_i|Y = y_k]$ $\sigma^2_{ik} = E[(X_i-\mu_{ik})^2|Y = y_k]$ for each attribute X_i and each possible value y_k of Y. Note there are 2nK of these parameters, all of which must be estimated independently. Of course we must also estimate the priors onY as well $\pi_k = P(Y = y_k)$ The above model summarizes a Gaussian Naive Bayes classifier, which assumes that the data X is generated by a mixture of class-conditional (i.e., dependent on the value of the class variable Y) Gaussians. Furthermore, the NaiveBayes assumption introduces the additional constraint that the attribute values X_i are independent of one another within each of these mixture components. In particular problem settings where we have additional information, we might introduce additional assumptions to further restrict the number of parameters or the complexity of estimating them. For example, if we have reason to believe that noise in the observed X_i comes from a common source, then we might further assume that all of the σ_{ik} are identical, regardless of the attribute i or class k (see the homework exercise on this issue). Again, we can use either maximum likelihood estimates (MLE) or maximum aposteriori (MAP) estimates for the parameters. The maximum likelihood estimator for μ_{ik} is

$\mu_{ik} = 1 \sum j\delta(Y j = y_k)\sum j X j i \delta(Y j = y_k)$

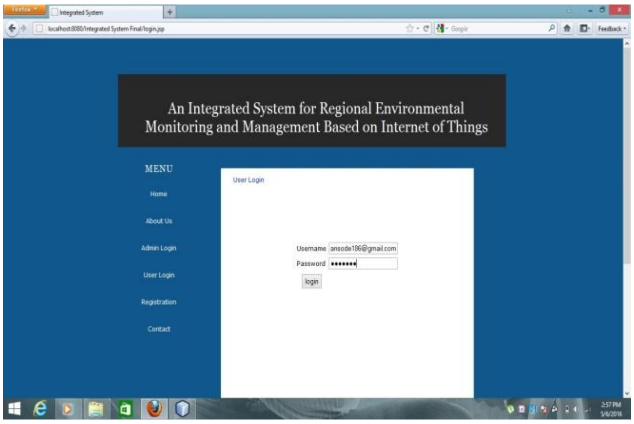
- **Flowchart of Naïve Bayes Algorithm:**



VII. RESULT ANALYSIS

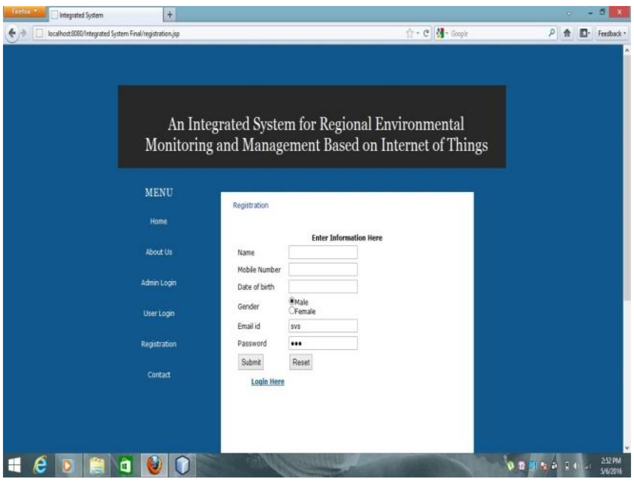
1. Image for home page

2. Image for User login

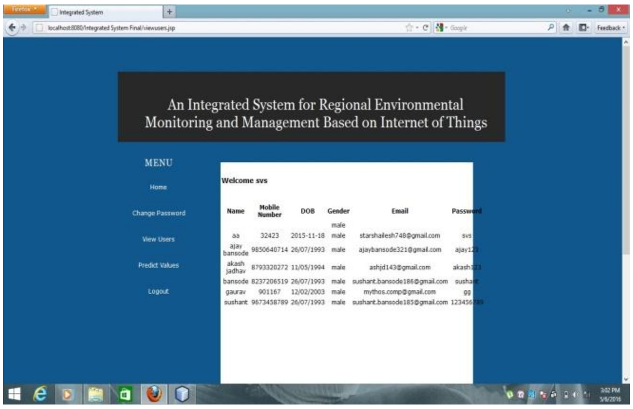


3. Image for Admin login

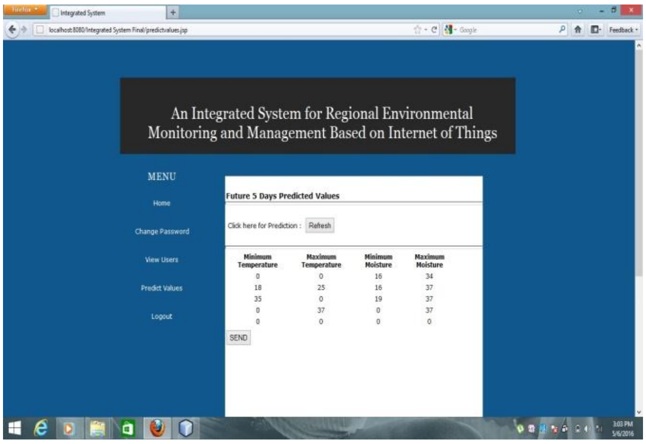
4. Image for User registration



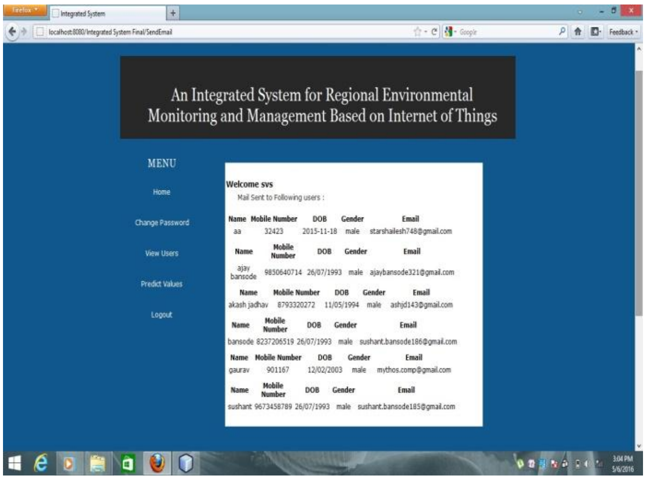
5. Image for user in database



6. Image for prediction



7. Image for sending mail



VIII. CONCLUSION AND FUTURE WORK

This paper introduces a novel IIS for regional environmental monitoring and management based on IoT for improving the efficiency of complex tasks, the proposed IIS combines IoT, Cloud Computing, Geoinformatics (RS, GIS, and GPS), and e-Science for environmental monitoring and management with a case study of regional climate change and its ecological responses, which is one of the most hot topics in the scientific world. The results showed that it is greatly benefited from such an IIS, not only in data collection supported by IoT but also in Web services and applications based on cloud computing and e-Science platforms, and the effectiveness of monitoring processes and decision-making can be improved obviously. The integrative system introduced in this work is valuable for the perception, transformation, processing, management, and sharing of multisource information in environmental monitoring and management, and it also provides a new paradigm for the future work, especially in the era of big data and IoT.

REFERENCES

[1] E. Welbourne, L. Battle, G. Cole, K. Gould, K. Rector, S. Raymer et al., “Building the Internet of things using RFID: The RFID ecosystem experience,” IEEE Internet Computer., vol. 13, no. 3, pp. 48–55, May–Jun. 2009.

[2] N. Niu, L. Xu, and Z. Bi, “Enterprise information systems architecture analysis and evaluation,” IEEE Trans. Ind. Informat., vol. 9, no. 4, pp. 2147–2154, Nov. 2013.

[3] M. Haklay, From Environmental Information Systems to Environmental Informatics: Evolution and Meaning. London, U.K.: Centre for Advanced Spatial Analysis, Univ. College London, 1999.

[4] L. Xu, Z. Li, S. Li, and F. Tang, “A decision support system for product design in concurrent engineering,” Decis. Support Syst., vol. 42, no. 4, pp. 2029–2042, 2007.

[5] H. Reuter, U. Middelhoff, F. Graef, R. Verhoeven, T. Batz,M.Weis,and B.Breckling,“Information system for monitoring environment al impacts of genetically modified organisms,” Environ. Sci. Pollut. Res., vol. 17, no. 8, pp. 1479–1490, 2010.

[6]S.Fang,L.Xu,H.Pei,Y.Liu,Z.Liu,Y.Zhuetal.,“An integrated approach to snowmelt flood forecasting in water resource management,” IEEE Trans. Ind. In format. vol. 10, no. 1, pp. 548–558, Apr. 2013.

