IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 42-48

Data minng techniques and IoT used for building a futuristic water conservation system

Mr Loukik Salvi1,Mrs Harshali Patil2
1 Department Of Computer Engineering, Thakur College Of Engineering & Technology, Mumbai, Maharashtra
2 Department Of Computer Engineering, Thakur College Of Engineering & Technology, Mumbai, Maharashtra ,AP-CMPN

Abstract : *Water scarcity is the major issue in the current scenario. Many places still face water issues. We aim at minimizing the wastage of water. This can be achieved at house level and later can be upgraded to industrial level as well. We plan on analyzing the water usage pattern of every family. Water scarcity is the major issue in the current scenario. Many places still face water issues. We aim at minimizing the wastage of water. This can be achieved at house level and later can be upgraded to industrial level as well. We plan on analyzing the water usage pattern of every family. We will be billing the family as per their monthly water usage. This can be achieved using flow meters and an Enhanced technique of Data Mining (SOM).The Flow meters will be used to measure the quantity of water used and water flow of every household The flow meter will help to measure the water used by the house on a regular interval of time. The SOM technique will help to study the recorded data, this will yield a the water usage pattern of each house (family) and thus we will come to know how much quantity of water is being utilised by each house.We will calculate the exact amount of water that a family will ideally need after studying the values and patterns we get after monitoring over a period of time, this will allow is to decide a tentative value of water that should be supplied to each house. After all the observations have been made and the monitoring has been done we will be providing only that much amount of water which was found to be sufficient for the respective families moreover some buffer amount of water will also be provided to deal with emergencies. Data Mining and IoT can be interfaced together to monitor the use of water and the excess use of water will be curbed.It is very important to choose the appropriate data mining technique to ensure the optimum output .*

Keywords*: SOM,C4.5,CART,Naïve Bayes, SVM, KNN, ADA Boost,EM,FLowmeters ,IoT.*

I. Introduction

Data Mining is used in many fields such as social networking sites, online shopping sites. It analyses the data that we browse and based on the analysis it shows the product that we are craving the that follow. There are several major data mining techniques have been developing and using in data mining projects recently including association, classification, clustering, prediction, sequential patterns and decision tree. Information mining is an integral asset that can discover examples and connections inside our information. Information mining finds concealed data from expansive databases . The by and large objective of the information mining process is to remove data from an informational collection and change it into a justifiable structure for further use. Informal organizations can be utilized in numerous business exercises like expanding informal advertising, showcasing investigate, General promoting, Idea age and new item advancement, Coinnovation, Customer administration, Public relations, Employee correspondences and in Notoriety the executives.internet of things.

II. Internet Of Things

As of late, advancement in figuring and customer hardware advances have activated Internet of Things (IoT) worldview. Web of Things(IoT) is portrayed as empowering influence that joins consistent items encompassing nature and plays out a type of message trade among them. The Internet of Things (IoT) is a gathering of articles that work mutually so as to serve purchaser assignments in a unified way. It ties computational capacity to convey information about the encompassing conditions. These gadgets can be in type of bespoke sensors, appliances,embedded frameworks, and information examination microchips.[1]The gigantic information created by the Internet of Things (IoT) are considered of high business esteem, and information mining calculations can be connected to IoT to remove concealed data from information. In this paper, we give an efficient method to survey information mining in learning view, procedure view, and application see, including order, grouping, affiliation examination, time arrangement investigation and exception examination. What's more, the most recent application cases are additionally reviewed. As an ever increasing number of gadgets associated with IoT, extensive volume of information ought to be broke down, the most recent calculations ought to be changed to apply to huge information.

The Internet of Things (IoT) and its applicable innovations can flawlessly incorporate established systems with organized instruments and gadgets. IoT has been assuming a basic job as far back as it showed up, which covers from customary gear to general family unit objects [1] and has been pulling in the consideration of scientists from the scholarly community, industry, and government as of late. There is an extraordinary vision that all things can be effectively controlled and checked, can be recognized naturally by different things, can speak with one another through web, and can even settle on choices without anyone else's input [2]. So as to make IoT more intelligent, bunches of examination advancements are brought into IoT; a standout amongst the most important innovations is information mining.

As indicated by the overview of enormous information mining framework and IoT framework, we propose the framework engineering for IoT and huge information mining framework.

(i)Devices: heaps of IoT gadgets, for example, sensors, RFID, cameras, and different gadgets, can be incorporated into this framework to apperceive the world and create information persistently.

(ii)Raw information: in the enormous information mining framework, organized information, semistructured information, and unstructured information can be coordinated.

(iii)Data accumulate: constant information and group information can be upheld and all information can be parsed, examined, and combined.

(iv)Data handling: heaps of open source arrangements are incorporated, including Hadoop, HDFS, Storm, and Oozie.

(v)Service: information mining capacities will be given as administration.

(vi)Security/protection/standard: security, protection, and standard are vital to huge information mining framework. Security and protection shield the information from unapproved access and security revelation. Enormous information mining framework standard makes information joining, sharing, and mining progressively open to the third piece of designer.

III. Data Mining

Data Mining (DM) enables new paths of urban planning, empowering the resilience of urban infrastructure and the adequacy of resources and systems DM is an ongoing research area, responding to the presence of large databases in commerce, industry and research.[15] It is a very useful technique in research; because, not only can someone extract meaningful information from certain databases, but can also predict changes ,discover patterns and relations hidden among the data (Fayyad et al., 1996). In addition, DM is an interactive process that requires the intuition, background knowledge and the computational efficiency of modern computer technology.

Data mining includes finding novel, intriguing, and possibly valuable examples from extensive informational collections and applying calculations to the extraction of concealed data. Numerous different terms are utilized for information mining, for instance, learning revelation (mining) in databases (KDD), learning extraction, information/design examination, information paleontology, information digging, and data reaping [3]. The target of any information mining process is to fabricate a productive prescient or illustrative model of a lot of information that best fits or clarifies it, as well as ready to sum up to new information [4]. In light of an expansive perspective of information mining usefulness, information mining is the way toward finding intriguing learning from a lot of information put away in either databases, information distribution centers, or other data archives

Based on the defination of data mining and the meaning of information mining capacities, a run of the mill information mining process incorporates the accompanying advances (see Fig 1).

(i) Information arrangement: set up the information for mining. It incorporates 3 substeps: coordinate information in different information sources and clean the clamor from information; remove a few sections of information into information mining framework; preprocess the information to encourage the information mining.

(ii) Information mining: apply calculations to the information to discover the examples and assess examples of found learning.

(iii) Information introduction: picture the information and speak to mined learning to the client.Units

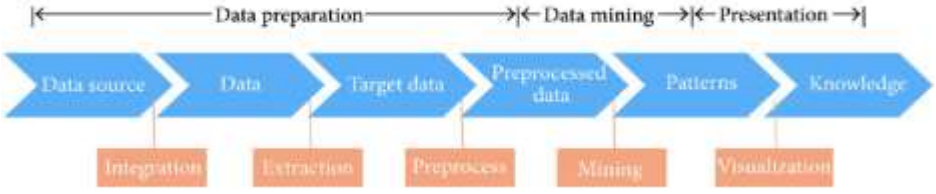

Fig. 1. The data mining overview.

IV. Data Mining Techniques

1.Grouping

Grouping is an exemplary information mining system dependent on machine learning.Essentially, characterization is utilized to arrange every thing in a lot of information into one of a predefined set of classes or gatherings.[27]Arrangement strategy makes utilization of scientific systems, for example, choice trees, direct programming, neural system, and insights. In characterization, we build up the product that can figure out how to order the information things into gatherings. For instance, we can apply characterization in the application that "given all records of workers who left the organization, foresee who will most likely leave the organization in a future period." For this situation, we isolate the records of representatives into two gatherings that named "leave" and "remain". And after that we can ask our information mining programming to characterize the representatives into isolated gatherings

3.Bunching

Bunching is an information mining strategy that influences a significant or valuable group of items which to have comparative attributes utilizing the programmed system. The grouping procedure characterizes the classes and places questions in each class, while in the characterization methods, objects are doled out into predefined classes.[20] To make the idea clearer, we can take book the board in the library for instance. In a library, there is a wide scope of books on different points accessible. The test is the means by which to keep those books such that perusers can take a few books on a specific point without issue. By utilizing the bunching method, we can keep books that have a few sorts of likenesses in a single group or one rack and mark it with a significant name. In the event that perusers need to get books in that theme, they would just need to go to that rack as opposed to searching for the whole library.

4.Forecast

The forecast, as its name inferred, is one of an information mining systems that finds the connection between free factors and connection among reliant and autonomous factors. For example, the forecast investigation system can be utilized in the deal to foresee benefit for the future in the event that we consider the deal is an autonomous variable, benefit could be a needy variable. At that point dependent on the chronicled deal and benefit information, we can draw a fitted relapse bend that is utilized revenue driven forecast.

5.Successive Patterns

Successive examples examination is one of information mining system that tries to find or recognize comparative examples, standard occasions or patterns in exchange information over a business period. In deals, with recorded exchange information, organizations can recognize a lot of things that clients purchase together unique occasions in a year. At that point organizations can utilize this data to suggest clients get it with better arrangements dependent on their buying recurrence before.

6.Decison trees

The A choice tree is a standout amongst the most regularly utilized information mining strategies since its model is straightforward for clients. In choice tree procedure, the foundation of the choice tree is a basic inquiry or condition that has different answers. Each answer at that point prompts a lot of inquiries or conditions that assistance us decide the information with the goal that we can settle on an official conclusion dependent on it. For instance, We utilize the accompanying choice tree to decide if to play tennis

V. Data Mining Algorithms

1. C4.5:

C4.5 is a calculation that is utilized to produce a classifier as a choice tree and has been created by Ross Quinlan. Also, so as to do likewise, C4.5 is given a lot of information that speak to things that have just been characterized. C4.5 that is frequently alluded to as a factual classifier is fundamentally an augmentation of Quinlan's ID3 calculation. The choice trees that are created by C4.5 can be additionally utilized for characterization. The C4.5 calculation has additionally been portrayed as "a milestone choice tree program that is presumably the machine learning workhorse most broadly utilized by and by to date" by the creators of the Weka machine learning programming.

2. **k-Mean:**

k-implies grouping that is otherwise called closest centroid classifier or The Rocchio calculation is a strategy for vector quantization, that is extensively prevalent for bunch examination in information mining. k-implies is utilized to make k bunches from a lot of items just with the goal that the individuals from a gathering

are increasingly comparative. It's a notable well known bunch examination system utilized for investigating a dataset.

3. Support vector machines:

With regards to machine learning, Support vector machines that are otherwise called help vector systems are essentially directed learning models that accompany related learning calculations which at that point dissect information that are utilized for the investigation of relapse and arrangement. A SVM display is made that is a portrayal of the precedents as focuses in space, that are additionally mapped with the goal that the instances of the different classes are then partitioned by an unmistakable hole that is should be as wide as would be prudent.[12]

4. Apriori:

Apriori is a calculation that is utilized for incessant itemset mining and affiliation rule learning by and large value-based databases. The calculation is continued by the distinguishing proof of the individual things that are visit in the database and afterward extending them to bigger itemsets as long as adequately those thing sets show up regularly enough in the database. These continuous itemsets that are controlled by Apriori can be utilized for the assurance of affiliation rules which at that point feature general patterns.[8]

5. EM(Expectation-Maximization):

An expectation– boost (EM) calculation, with regards to measurements is an iterative technique that is utilized to discover greatest a posteriori(MAP) or most extreme probability appraisals of parameters in factual models, that essentially relies upon in secret inert factors.

6. PageRank(PR):

PageRank (PR) that was named after Larry Page who is one of the founders of Google is an algorithm that is used by Google Search to rank the websites in their search engine results. PageRank, that is the first algorithm that was used by the company is not the only algorithm that is being used by Google to order search engine results, but it is the best-known way of measuring the importance of website pages.

7. AdaBoost:

Adaptive Boosting or AdaBoost, that has been planned by Yoav Freund and Robert Schapire is a machine learning meta-calculation, that won the originators the 2003 Godel Prize for the equivalent. The calculation can be utilized in arrangement with numerous different kinds of learning calculations so as to enhance execution. AdaBoost is touchy to uproarious information just as anomalies.

8. kNN:

The k-nearest neighbors algorithm (k-NN) is a kind of sluggish learning or instance based learning and is considered as a non-parametric technique that is utilized for characterization and regression.In both the referenced cases, the info comprises of the k nearest preparing models in the component space and the yield relies upon whether the calculation is being utilized for arrangement or relapse.[26]This kNN Algorithm is considered and is additionally among the least difficult of all machine learning calculations.

9. Naive Bayes:

With regards to machine learning, Naive Bayes classifiers that are viewed as very versatile are known to be a group of straightforward probabilistic classifiers that are completely depended on the use of Bayes' hypothesis with the help of solid autonomous suspicions between the highlights and the provided data set.

10. CART:

CART is a calculation that essentially represents characterization and relapse trees. It is a choice tree learning system that either yields order or relapse trees and comparatively like C4.5, CART is likewise a classifier. A large number of the reasons that a client would utilize C4.5 for additionally apply to that of CART, since them two are choice tree learning systems and highlights like simplicity of elucidation and clarification are connected to CART also

11.Self-Organizing Map (SOM)

The Self-Organizing Map is one of the most popular neural network models. It belongs to the category of competitive learning networks. The Self-Organizing Map is based on unsupervised learning, which means that no human intervention is needed during the learning and that little needs to be known about the characteristics of the input data. We could, for example, use the SOM for clustering data without knowing the class memberships of the input data. The SOM can be used to detect features inherent to the problem and thus has also been called

SOFM, the Self-Organizing Feature Map. The SOM algorithm is based on unsupervised, competitive learning. It provides a topology preserving mapping from the high dimensional space to map units. Map units, or neurons, usually form a two-dimensional lattice and thus the mapping is a mpapping from high dimensional space onto a plane.[23] The property of topology preserving means that the mapping preserves the relative distance between the points. Points that are near each other in the input space are mapped to nearby map units in the SOM.

The SOM can thus serve as a cluster analyzing tool of high-dimensional data. Also, the SOM has the capability to generalize. Generalization capability means that the network can recognize or characterize inputs it has never encountered before. A new input is assimilated with the map unit it is mapped to. Self-Organizing Map (SOM) technology. The Self-Organizing Map is one of the most popular neural network models. It belongs to the category of competitive learning networks.[24]The Self-Organizing Map is based on unsupervised learning, which means that no human intervention is needed during the learning and that little needs to be known about the characteristics of the input data. We could, for example, use the SOM for clustering data without knowing the class memberships of the input data. The SOM can be used to detect features inherent to the problem and thus has also been called SOFM, the Self-Organizing Feature Map.

Previously research was performed on automatic classification of daily water consumption patterns for a household in Sosnowiec, using data collected by sensors. Their investigation is built upon three approaches accomplished with use of the SELF ORGANISED MAPS (SOM) algorithm. Thirteen descriptive features of daily consumption patterns are used for the classification. In future scenarios, this investigation could be expanded to more households in order to achieve a further classification, even manage to identify each day of the week.The thought behind a SOM is that you're mapping high-dimensional vectors onto a littler dimensional (commonly 2-D) space. You can consider it bunching, as in K-implies, with the additional distinction that vectors that are close in the high-dimensional space likewise end up being mapped to hubs that are close in 2-D space.

SOMs accordingly are said to "protect the topology" of the first information, on the grounds that the separations in 2-D space mirror those in the high-dimensional space. K-implies likewise groups comparable information focuses together, yet its last "portrayal" is difficult to envision since it's not in a helpful 2-D design.

A run of the mill model is with hues, where every one of the information focuses are 3-D vectors that speak to R,G,B hues. At the point when mapped to a 2-D SOM you can see areas of comparable hues start to create, which is the topology of the shading spacect the investigation of this classification potential, we use the Kohonen Self-Organizing Maps (SOMs) methodology. A SOM allows the representation of a variety of high-dimensional data items, by translating them in a quantitative two-dimensional image in an orderly fashion [9]. Each data point is mapped in a single point in the map, the node, and similarities among the items are indicated by their distances on the map. A SOM is able to cluster data, while at the same time it orders the clusters, forming reduced abstractions of complex data. SOMs are used for analysis in economy to compare enterprises at different levels, in industry to monitor and describe the masses of different input states by ordered clusters, while in science and technology the applications are vast with research objects being classified on the basis of their properties. The method has been in practical use in scientific fields, as well as in finance and other areas since 1982 [10]. It is a special type of artificial neural network that conducts a nonlinear mapping from multi-dimensional data to a low-dimensional space, while it preserves the most important metric and topological relationships of the original data; this way, a SOM actually clusters the data. A SOM relies on unsupervised learning to group input vectors into regions of a map, while each vector is assigned to a specific region depending on its Euclidean distance to already mapped vectors. Clustering procedures are then applied to segment vectors within neighboring regions into clusters [8]. SOMs can also be useful for anomaly detection and missing data reconstruction [12], two functions that can be very useful in the context of this study and smart water in general

Algorithm	**Algorithm Merits Demerits**	**Algorithm Merits Demerits**
Decision Tree	1. It can handle both continuous and discrete data. 2. It provides fastresult in Classifying unknown records. 3. It works well with redundant attribute.It provides good results with small size tree.Results does not affect with outliers. 4. It does not require preparation method like normalization.It also works well with numeric	1.It can't predict the value of a continuous Class attribute. 2.It provides error prone results when too many classes are used.Irrelevant attribute affect construction of decision tree in a bad manner. Small change in data can change the decision tree completely.
Naïve Bayesian	1.It provides high accuracy and speed on large database. 1. It has minimum error rate	It assumes independence of features.So it provides less accuracy.

	in comparison to all 2. other classifier.It is easy to understand.It is not sensitive to irreverent.It can also handle real and discrete	
C4.5	1. It uses continue data. 2. It avoids over fitting of data. 3. It improvescomputational efficiency. 4. It handles training datawith missing and numeric value	It requires that target attribute will have only discrete values.
CART	1. It is non- parametric. 2. It does not requt	1. It may have unstable decision tree. 2. It splits only by one variable.
K-Nearest Neighbor	1. It performs better with missing data 2. It is easy toimplement and Debug. 3. It provides more accurate results. Some noise reductionTechniques are used that improve the accuracy of classifier.	1. It has poor run time performance. 2. It requires high calculation complexity. 3. It considers no weight difference between samples. 4. It is sensitive to irrelevant and Redundant feature.
K-Means	1. It is Reasonable fast. 2. It is very simple and robust algorithm. 3. It provides best results when datasets are distinct	1. It can‟t work with non-linear data sets. 2. It can't handle noisy data and outliers.

Table 1.Comaprison of various Data mining techniques

Model Fitness (through using training set)				Model Accuracy (through using testing set)			
Specificity	Sensitivity	Precision	Trainin g Accuracy	Specificity	Sensitivity	Precision	Testing accuracy
89.62 %	83.61 %	85.71 %	85.50 %	89.90 %	95.23 %	90.90 %	89.02%
84.90 %	79.48 %	79.48 %	83.61 %	90.93 %	80.95 %	89.47 %	87.05%
91.50 %	79.48 %	87.32 %	84.41 %	86.63 %	88.09 %	88.09 %	86.37%
91.50 %	78.20 %	87.14 %	86.87 %	86.36 %	73.80 %	83.78 %	82.23%

Table 2. Comparison on model fitness and model accuracy of six various applied machine learning algorithms

VI. Conclusion

The data mining techniques discussed above can be used in order to build a futuristic water conservation system which will monitor the usage of water and accordingly bill the people.The payment of water bill will be based on the classification and quantity of water used by the particular family. Thus families will have to pay fairly for the amount if water used. Hence, this will also help to stop wastage of water.Our project aims at helping the civic body and housing societies in proper planning of water supply, to avoid any future water scarcity issues. Water management will be more organized. Water wastage will be reduced to a greater extent. It will greatly help the civic body in proper planning of water supply. It will helpful to implement many government undertaken projects regarding water management.

[1] In this work, four classifiers including C5.0, SVM, KNN and Neural Network. Information partitioned into trainset and testset (70% and 30% individually). The preparation set is utilized to construct the classifier and test set used to approve it. Demonstrate improvement is directed in two fundamental advances including model wellness and model precision. To figure the model wellness criteria we utilized the information of preparing set; be that as it may, to process the model exactness estimations, information of testing set is connected which is only substantially more profitable to make a decision about our models precision.

References

[1]. A.E. Ioannou, D. Kofinas, A. Spyropoulou and C. Laspidou* "Data mining for household water consumption analysis using selforganizing maps.", E.W. Publications, Volos 38334, Greece, 2017.
[2]. http://www.flowmeters.com
[3]. ThinagaranPerumal,Md Nasir Sulaiman,Leong.C.Y,"Internet of Things (IoT) Enabled Water Monitoring System", 4th Global Conference on Consumer Electronics (GCCE),IEEE 2015.
[4]. Perumal, T.; Sulaiman, M.N.; Mustapha, N.; Shahi, A.Thinaharan, R., "Proactive architecture for Internet of Things (IoTs) management in smart homes," Consumer Electronics (GCCE), 2014 IEEE 3rd Global Conference on, pp.16,17, 7-10 Oct. 2014.
[5]. Perumal, T.,M.N.Sulaiman and Leong C.Y, "ECA-Based interoperability framework for intelligent building. Automation in Construction. 31, 274–280 (2013).
[6]. Yin Jie,Ji Yong Pei,LiJun,GuoYun,XuWei,"Smart Home System Based on IOT Technologies," Computational and Information Sciences (ICCIS), 2013 Fifth International Conference on, pp.1789,1791, 21-23 June 2013.
[7]. Vinayak Vakare,RamratanPrajapati,ShivamYadav,VijaypalYadav,SayaliWadekar,"Smart Water Managment using IoT",IEEE 2016.
[8]. Towards an IoT based water management system for a campus, PrachetVerma ; Department of Electronic Systems Engineering, Indian Institute of Science,Bangalore ; Akshay Kumar ; NiheshRathod ; Pratik Jain.
[9]. CC3200 SimpleLink Wi-Fi® and Internet-of-Things solution, a Single-Chip Wireless MCU, www.ti.com.
[10]. Arampatzis, G., Perdikeas, N., Kampragou, E., Scaloubakas, P., and Assimacopoulos, D., 2014. A water demand forecasting methodology for supporting day-to-day management of water distribution systems. In 12th International Conference "Protection and Restoration of the Environment", Skiathos, Thessaloniki, Greece.
[11]. Kaski, S. 1997. Data Exploration Using Self-Organizing Maps, Ph.D. thesis, Helsinki University of Technology.
[12]. Kohonen, T. 1995. Self-Organizing Maps, Springer, Berlin.
[13]. Kohonen, T., Oja, E., Simula, O., Visa, A. and Kangas, J. 1996. Engineering applications of the self-organizing map. Proceedings of the IEEE, 84(10), 1358-1384.
[14]. Laspidou, C. 2014. ICT and stakeholder participation for improved urban water management in the cities of the future. Water Util. J,8, 79-85.
[15]. Simula, O. and Kangas, J. 1995. Process monitoring and visualization using self-organizing maps, in: Neural Networks for Chemical Engineers, Computer-Aided Chemical Engineering, vol 6, Elsevier, Amsterdam.
[16]. Vesanto, J., Himberg, J., Alhoniemi, E. Parhankangas, J. 1999, November. Self-organizing map in Matlab: the SOM Toolbox. In Proceedings of the Matlab DSP conference, 99, 16-17.
[17]. Yang, L., Yang, S.-H., Magiera, E., Froelich, W., Jach, T. and Laspidou, C. 2017. Domestic water consumption monitoring and behaviour intervention by employing the internet of things technologies. Procedia Computer Science, 111, 367-375.
[18]. Bishop, C.M. 1995. Neural Networks for Pattern Recognition, Oxford University Press, Oxford.
[19]. Deboeck, G and Kohonen T. 1998. Visual Explorations in Finance using self-organizing Maps, Springer, London.
[20]. Fayyad, U.M., Piatetsky-Shapiro, G., Smyth, P., and Uthurusamy R. 1996. Advances in knowledge Discovery and Data Mining, AAAI Press/The MIT Press, California.
[21]. Fry, Carolyn. The Impact of Climate Change: The World's Greatest Challenge in the Twenty-first Century, New Holland Publishers Ltd. 2008.
[22]. India set to become water scarce by 2025: report, MUMBAI, May 25, 2015. http://www.thehindu.com/. Date accessed: 22 February, 2016
[23]. Walmsly, N., & Pearce, G. Towards Sustainable Water Resources Management: Bringing the Strategic Approach up-to-date. Irrigation & Drainage Systems, (2010); 24(3/4), 191-203.
[24]. Global changes in fresh water supply. http://www.globalchange.umich.edu/. Date accessed: 24 February, 2016
[25]. Yang Ji,et.al,"Analysis of Urban Residential Water Consumption Based on Smart Meters and Fuzzy Clustering", IEEE(2015)
[26]. HaijiangTai,et.al."An Integrated System for Advanced Water Risk Management Based on Cloud Computing and IoT", IEEE(2015)
[27]. [28] http://digital.csic.es/bitstream/10261/127788/7/D-c- %20Arduino%20uno.pdf. Date accessed: 24 February, 2016.
[28]. [29] Thingspeak official site. https://thingspeak.com/. Date accessed: 24 February, 2016.