Integration of Sensor Networks to IoT for Monitoring the Samplings

[1]Megha Milana N, [2]Dr M Z Kurian
[1]PG Scholar, [2]Professor and HOD,
Department of Electronics and Communication Engineering
Sri Siddhartha Institute of Technoogy, Tumakuru, Karnataka, India

***Abstract*: Wireless Sensor Network (WSN) has been one of the most prominent research areas over last decade. It attributed in many different areas of applications including agriculture, defence, Environmental studies and so on. But one of the inherent flaw with the design of Sensor networks is that the range of the network is limited due to limited radio range. Further as WSN mainly uses 802.15.4 as link layer protocol to save power, the effective bandwidth is limited to only 256 kbps. This restricts the sensor network as low computation data processing and data collection network.**

Internet of things (IoT) has opened up a whole new possibilities in microcomputer and hardware by introducing the ability to connect smaller hardware to internet and by allocating individual IP addresses to these devices by leveraging IPv6 addressing scheme. IoT enables the devices to connect to internet with higher bandwidth. These devices can now access host of services offered through cloud including data mining services, storage and visualization services, security services and so on.

In this work we present a novel Cloud based Agro Sensor network to monitor the weather and soil parameters of a large agricultural field which offers a data mitigation and analysis services over cloud. The proposed work is built with Intel Edison IoT devices which offers a scalable IoT architecture. We use ThingSpeak data cloud for data logging and monitoring. Results shows that the proposed work provides reliable data logging in a reliable distributed environment.

***Index Terms*— IoT, Intel Edison, Wireless Sensor Networks**

I. INTRODUCTION (HEADING 1)

A conventional sensor network is a radio network of sensor nodes with ability to sense physical parameters, store sensed data, carry out simple processing on data and forward the data through radio interface. The objective of such network is to push the data to a sink node which can then forward the data to server (or cloud).
However many real time applications includes sensors spread over long areas. As such they are treated as independent networks. Internet of Things is a new paradigm of connecting devices like micocontrollers and smart objects to cloud. Using IoT services, we can now connect sensors to internet directly.
One of common design of sensor network includes cluster based methods where clusters are at formed by a group of nodes. These are also called coordinator nodes. These nodes gather data from all neighbouring nodes. If these nodes can be linked to internet with their unique IP addresses, then the sensor network can be infinitely scaled (theoretically).
The proposed research work aims at addressing the issues and challenges with the aforementioned objective of integrating sensor network over cloud using IoT services. So Internet of Things or IoT basically is connecting Embedded System to internet. Figure 1 presents conceptual diagram of how basic hardware devices can be connected to could using IoT. Figure 2 presents the architecture of IoT.

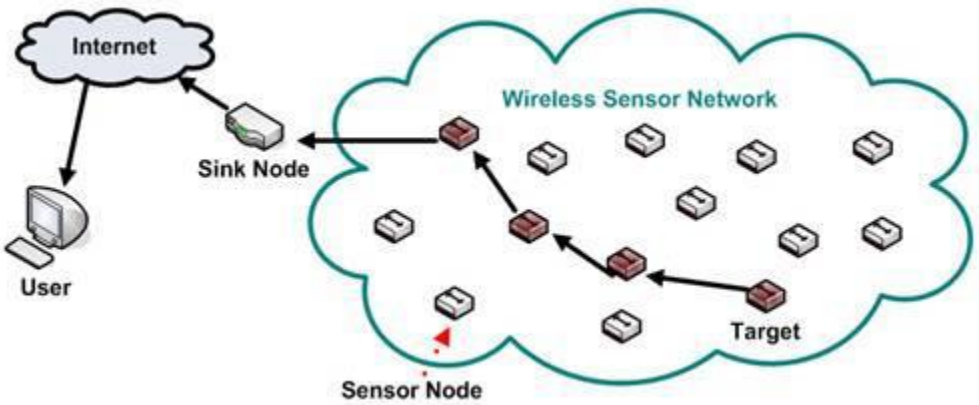


Figure 1: Conventional Sensor Network

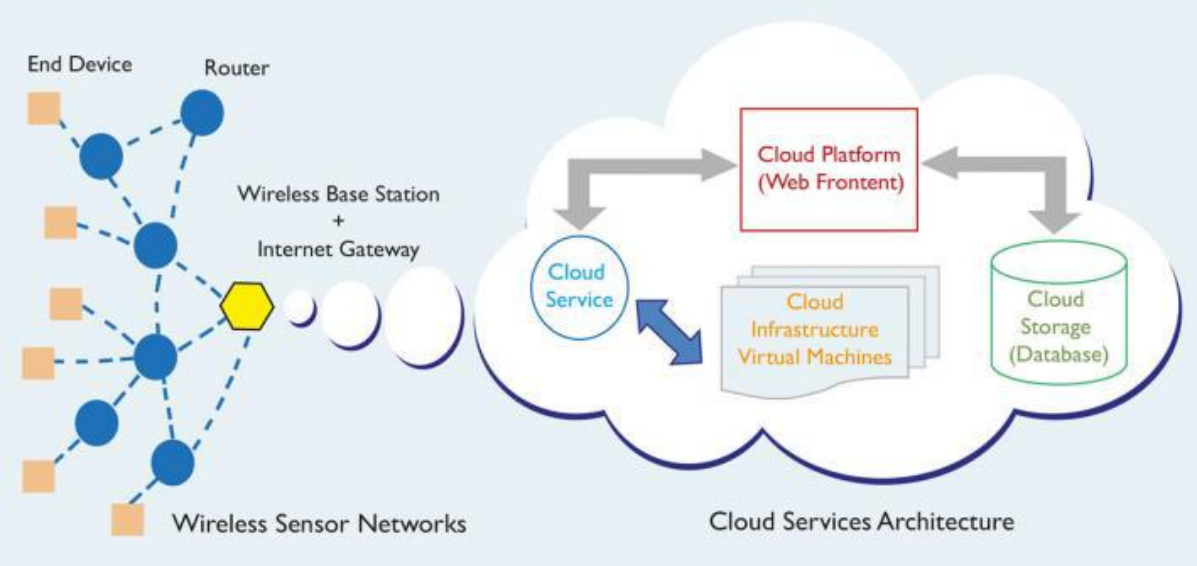


Figure 2: Sensor Network over cloud

II. LITRATURE REVIEW

Charith perera and Arkady [1] proposed a project using IOT techniques to demonstrate an adjustable living environment control system. D.L.Yang and F. Liu [2] made a survey of the IOT based RFID systems ,sensor networks and intelligence in smart objects and also it enables communication between people and things and between things themselves. Caragliu et al, [3] proposed a project on smart cities in Europe using IoT techniques and demonstrated an advance triple-helix network model for smart performance. Global K.Ashton [4] described that „internet of things" as thing in real world, things matter more than ideas by linking the new idea of RFID in P&G" s supply chain to the then red-hot topic of the internet. A.Zaslavsky et al.,[5] explained sensing as a service and big data using Data streams coming from these devices will challenge the traditional approaches to data management and contribute to the emerging paradigm of bigdata. H. Sundmaeker and P.Guillemin [6] explored the Vision and challenges for realizing the internet of things based key enabling technology like cloud implementation using aneka which is based on interaction of private and public cloud presented. P.Guillemin and P.Friess [7] described internet of things strategic research roadmap using IoT technology which allows to identify research and develop challenges and outlining a roadmap for a future reliable technique. H Chourabi and T Nam[8] proposed the concept of Understanding smart cities, an integrative frame work using management & organization, technology, governance policy, context ,people and communities ,economy, built infrastructure and natural environment. Hemant Ghayvat et al.,[9] proposed a WSN and IOT based Smart Homes And Their Extension To Smart Buildings to develop smart living environment. Younis, M et al.,[10 a survey on Topology management techniques for tolerati] conducted ng node failures in wireless sensor networks."Which focused on network topology management techniques for tolerating/handling node failures in WSNs. Challoo, R et al.,[11] gave an Overview and Assessment of Wireless Technologies and Co-existence of ZigBee, Bluetooth and Wi-Fi Devices. "to show that there is a severe degradation on ZigBee and Bluetooth packet transmission of packets as well as re-transmission of ZigBee packets when Wi-Fi is operating. Hwang, K et al.,[12]proposed a Enhanced self-configuration scheme for a robust ZigBee-based home automation which is an enhanced self-configuration (ESC) scheme that improves the robustness of the conventional ZigBee-based home automation systems by coping well with orphan propagation problem and dynamic error environments. Byun,J et al.,[13] proposed an intelligent self-adjusting sensor for smart home services based on ZigBee Communications.which is a situation-based self adjusting scheme, and also an event-based self-adjusting sensor network and hardware and middleware implementation. Bell, C et al., [14] proposed a concept of Examining social media use among older adults. for understanding the factors that influence social media use in older adults. Dawadi, P.N et al., [15] made an Automated assessment of cognitive health using smart home technologies. whose goal was to develop intelligent systems to monitor the well being of individuals in their home. .

III PROPOSED WORK:

Problem Statement:

Internet of things (IoT) has opened up a whole new possibilities in microcomputer and hardware by introducing the ability to connect smaller hardware to internet and by allocating individual IP addresses to these devices by leveraging IPv6 addressing scheme. IoT enables the devices to connect to internet with higher bandwidth. These devices can now access host of services offered through cloud including data mining services, storage and visualization services, security services and so on. Therefore IoT brings to table the ability to connect WSN over cloud. The coordinator nodes can be connected to internet through IoT. These coordinators can gather and process data locally from nearby sensor over existing WSN protocols. This data can then be stored and processed over cloud through IoT framework. This leads to exciting new opportunities. For example now a fire sensing system can trigger fire fighting water outlet driven by relayes and controlled via PLC to trigger water outflow on areas where fire is caught up.

However review of literature reveals very little work in the direction of perceiving WSN over cloud through IoT. There is a distinct need of extensive research and new paradigms that enables defines new services and protocols in this area. In this research we would like to explore this void research area and come up with practical solutions in service, architecture and protocol level for integrating WSN with IoT without significant change in basic WSN or IoT framework.

Methodology:

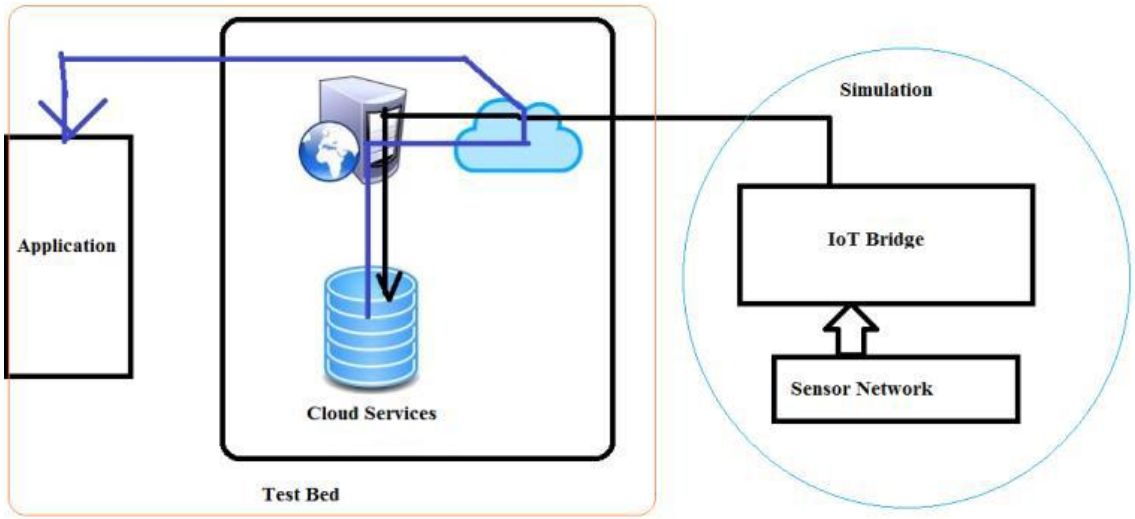


Figure 3: Proposed Block Diagram

Overall methodology can be explained with the simple diagram. We use several Hygrometer Sensors and Temperature and Humidity sensor combined with Arduino to monitor environmental and soil parameters. These monitoring nodes acts like individual sensor nodes and mitigate the measured data to Intel Edison Coordinator. The Coordinator logs the data in ThingSpeak cloud.

Hardware Setup:

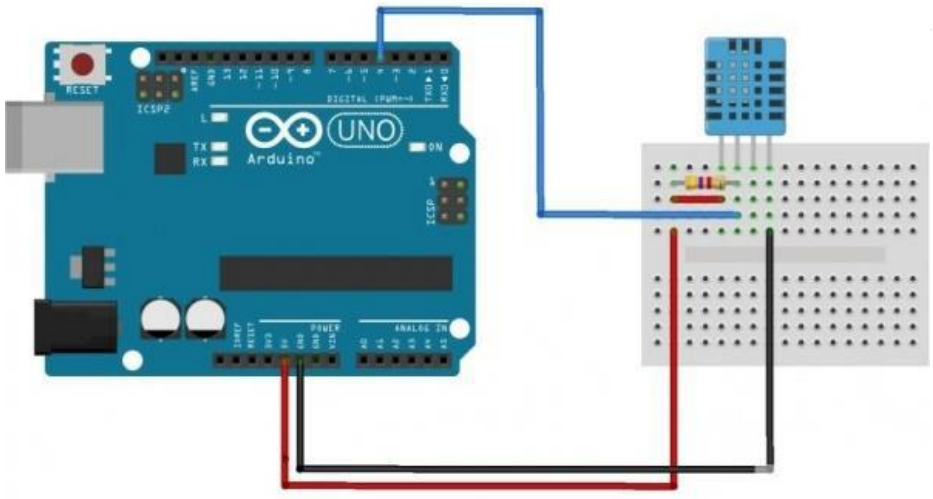


Figure 4: Environmental sensor with Arduino

ThingSpeak Data Logging:

ThingSpeak can be used with our hardware to provide a seamless connectivity with our device from internet. ThingSpeak offers creating free public channel. In each channel, 8 parameters can be logged. A ThingSpeak channel is like a database field which comes with Custom APIs that can be used to store and retrieve data remotely.

"*A channel is where you send your data to store. Each channel includes 8 fields for any type of data, 3 location fields, and 1*

status field. Once you have a ThingSpeak Channel you publish data to the channel, have ThingSpeak process the data, then have your application retrieve the data."

ThingSpeak supports data logging and retrieval using JSON. It also provides a data visualization service whereby every logged data can be readily visualized in mobile/any internet devices. Logged data is available in real time with visualization service.

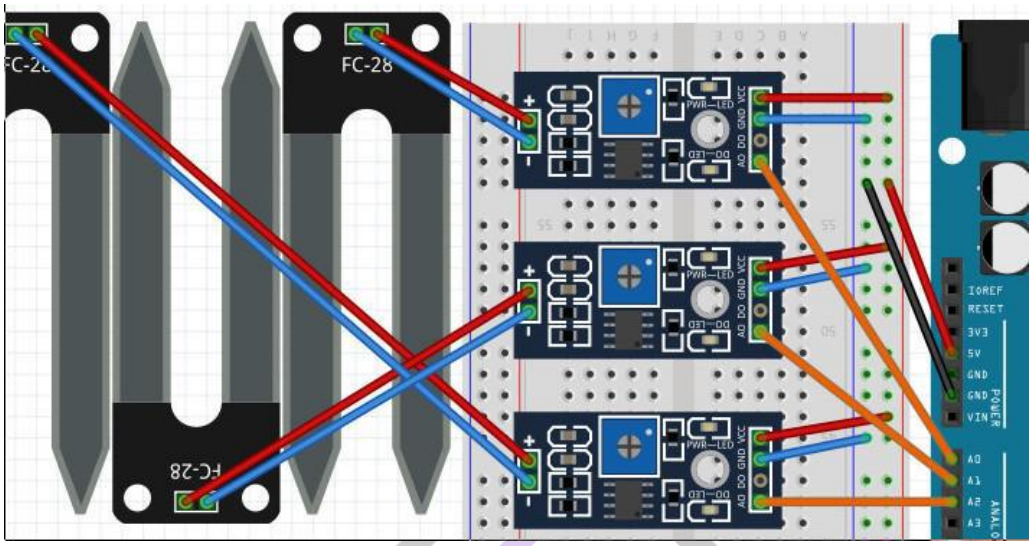


Figure 5: Multiple Hygrometer connection with Arduino

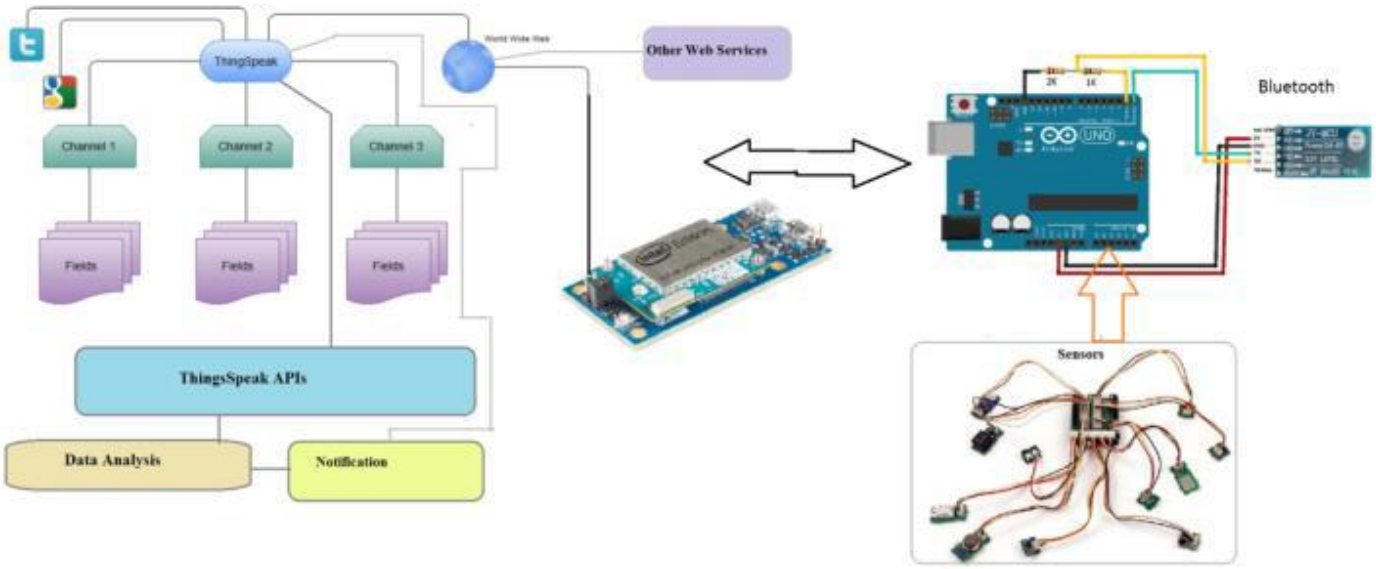


Figure 6: Overall Hardware level block diagram of the work.

Figure 7 : Result of Data Viewing of a ThingSpeak Channel

IV RESULTS:

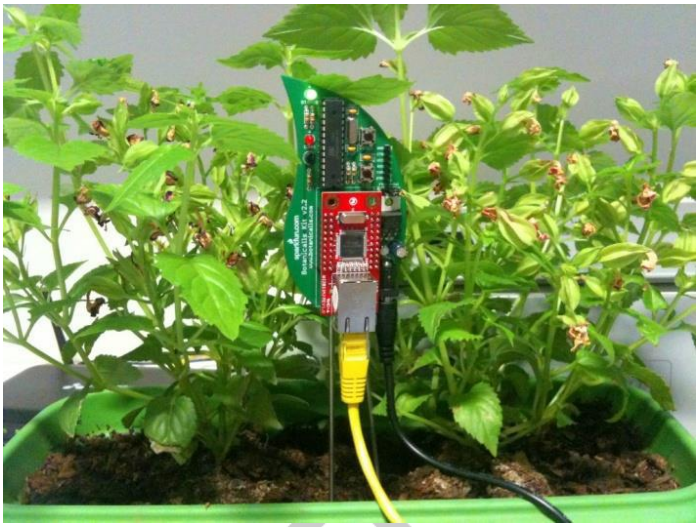
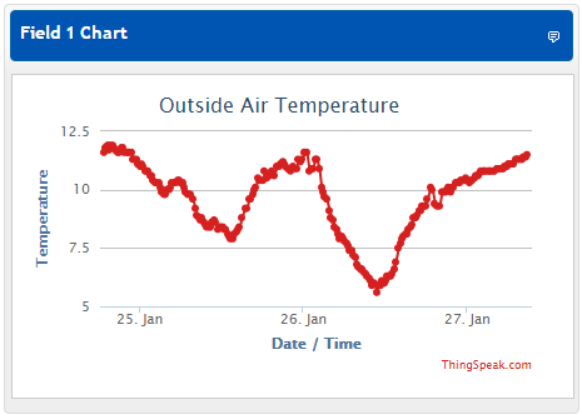
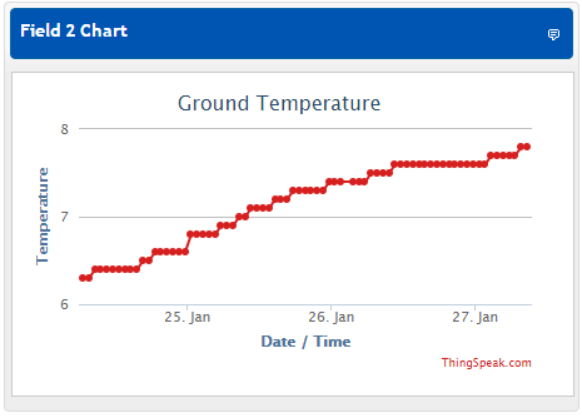
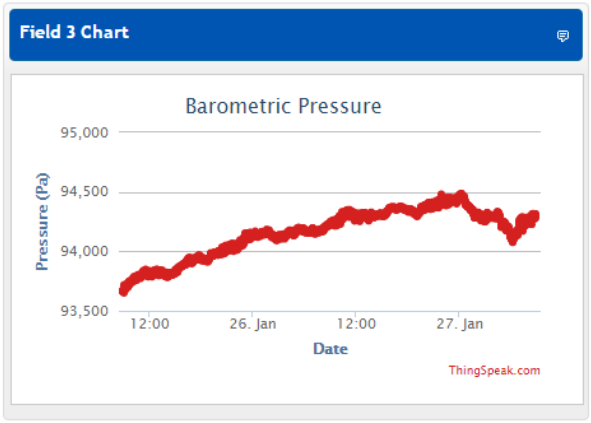


Figure 8: Independent IoT node







Field 1 represents air temperature collected using temperature sensor. Field 2 is hygrometer data which monitors ground temperature. Field 3 gives air pressure.

We can see that the proposed network is quite stable over the time and data is collected almost at every regular interval. There is no connectivity drop or "void data" region. This proves that the proposed design is extremely stable. It also proves that proposed work is extremely suitable for multi parameter monitoring of agriculture data. As ThingSpeak offers a ready integration with Matlab, this data can be easily used for data analysis.

5. CONCLUSION

In the proposed work we mainly focused on building a more comprehensive state of art cloud extension of WSN for agriculture using IoT framework. Firstly we build isolated IoT nodes with low power, low cost Arduino devices which mitigates the data to a cloud connected IoT device. In this way every IoT central device acts like a coordinator and forms a "star" topology with it's peers. The nodes are provided time slots. Therefore collision is avoided. Due to low power consumption, the isolated nodes last for a long period of time which is an essential requirement for the work. One of the good results is a unique framework to connect existing WSN to cloud. Then system prove the advantage of such extension by demonstrating the scale of improvement in data analysis services. Results prove that IoT can be used to create mesh sensor networks and enhanced bandwidth can be used to connect sensor network with other control system.
Results clearly demonstrate the pros and cons of the layers and designed protocols though quantitative analysis and must be presentable as proof of concept for system robustness.

REFERENCES

[1]CharithPerera,ArkadyZaslavsky,PeterChristen,DimitriosGeorgakopoulos,:"Transactions On Emerging Telecommunications Technologies Trans. Emerging Tel. Tech.",2014; 00:1–12
[2] D.-L. Yang, F. Liu, and Y.-D. Liang, "A survey of the internet ofthings," in International conference on EBusinessIntelligence(ICEBI-2010),ser.Advancesin Intelligent Systems Research. Atlantis Press, 2010, pp. 358–366.
[3] A. Caragliu, C. D. Bo, and P. Nijkamp, "Smart cities in europe," in 3rd Central European Conference in Regional Science-CERS, October 2009, pp. 45–59.
[4] K. Ashton, "That ‟ internet of things‟ thing in the real world, things matter more than ideas," RFID Journal, June 2009, http://www.rfidjournal.com/article/print/ 4986 [Accessed on: 2012-07-30].
[5] A. Zaslavsky, C. Perera, and D. Georgakopoulos, "Sensing as a service and big data," in International Conference on Advances in Cloud Computing (ACC2012), Bangalore, India, July 2012, pp. 21–29.
[6] H. Sundmaeker, P. Guillemin, P. Friess, and S. Woelffle, "Vision and challenges for realising the internet of things," European Commission Information Society and Media, Tech. Rep., March 2010, http://www.internet-of-things-research.eu/pdf/IoTClusterbook March 2010.pdf [Accessed on: 2011-10-10].
[7] P. Guillemin and P. Friess, "Internet of things strategic research roadmap," The Cluster of European Research Projects, Tech. Rep., September 2009, http://www.internet-of-things-research.eu/pdf/ IoT Cluster Strategic Research Agenda 2009.pdf.
[8] H. Chourabi, T. Nam, S. Walker, J. Gil-Garcia, S. Mellouli, K. Nahon, T. Pardo, and H. Scholl, "Understanding smart cities: An integrative framework," in System Science (HICSS), 45th Hawaii International Conference on, 2012, pp. 2289–2297.
[9]HemantGhayvat, SubhasMukhopadhyay , Xiang Gui And NagenderSuryadevara," WSN- And IOT-Based Smart Homes And Their Extension To Smart Buildings ",Sensors 2015, 15, 10350-10379; doi:10.3390/s150510350
[10] Younis, M.; Senturk, I.F.; Akkaya, K.; Lee, S.; Senel, F. Topology management techniques for tolerating node failures in wireless sensor networks: A survey. Comput.Netw. 2014, 58, 254–283.
[11]Challoo, R.; Oladeinde, A.; Yilmazer, N.; Ozcelik, S.; Challoo, L. An Overview and Assessment of Wireless Technologies and Co-existence of ZigBee, Bluetooth and Wi-Fi Devices. Proced.Comput. Sci. 2012, 12, 386–391.
[12] Hwang, K.-I.; Choi, B.-J.; Kang, S.-H. Enhanced self-configuration scheme for a robust ZigBee-based home automation. IEEE Trans. Consum. Electron. 2010, 56, 583–590.
[13]Byun, J.; Jeon, B.; Noh, J.; Kim, Y.; Park, S. An intelligent self-adjusting sensor for smart home services based on ZigBee Communications. IEEE Trans. Consum. Electron. 2012, 58, 794–802.
[14] Bell, C.; Fausset, C.; Farmer, S.; Nguyen, J.; Harley, L.; Fain, W.B. Examining social media use among older adults. In Proceedings of the 24th ACM Co6nference on Hypertext and Social Media, Paris, France, 1–3 May 2013; pp. 158–163.
[15]Dawadi, P.N.; Cook, D.J.; Schmitter-Edgecombe, M.; Parsey, C. Automated assessment of cognitive health using smart home technologies. J. Tech. Health Care 2013, 21, 323–343.