Intelligent Device To Device Communication With Wi-Fi Using Iot

Pallavi.P.Dabir[1], Mr.A.V.Walke[2]
[1] *M.E. (E & TC) student, P.V.P.I.T., Pune*
[2] *Assistant professor, E&TC dept., P.V.P.I.T., Pune*

Abstract **-** Device to device communication is very useful in field of IoT (Internet of Things) .Analogous to the way humans use the Internet, devices will be the main users in the Internet of Things (IoT) ecosystem. D2D communication technologies (e.g., Bluetooth, Zigbee, and Wi-Fi) are popular networks that can be used in the IoT. The presented design consists of two devices which are communicating to each other through Wi-Fi which is used in IoT system. These two devices are self intelligent. That means they can independently take their own decisions depending upon system requirements. Devices continuously transfer their data to each other depending on sensors values which are attached to it. These two systems can be any interdependent systems. Such type of device to device communication is very useful in the field of IoT. Two devices can be controlled and monitored through android application. So continuous human intervention is not required which is important part in IoT systems.

Keywords **-** *Android, Communication, Device, IoT, Wi-Fi.*

I. INTRODUCTION

D2D communication is an integral part of the IoT environment to design, deploy, and maintain a sustainable IoT ecosystem [1]. Some of the IoT research issues include energy efficiency, routing, security, context-awareness protocols, etc. there is focus on issues that impact intelligent D2D communication in the IoT environment. They analyzed state-of-the-art communication mechanisms in licensed and unlicensed spectra and routing techniques that can support intelligent D2D communications. [1].

The **Internet of Things** (**IoT**) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing internet infrastructure.

There are many IoT applications such as smart parking, home automation, health, buildings, transport, smart city, etc.

Smart systems & Internet of things are driven by the combination of sensors & actuators, connectivity and people & processes.

Sensors & Actuators: They are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes e.g. flow, chemical/gas, humidity, acceleration, motion, position, etc.

Connectivity: These inputs are digitized & placed onto the network. Such as Ethernet, Wi-Fi, Zigbee, NFC, Bluetooth, WiMAX, etc.

People and processes: These networked inputs can then be combined into bi-directional systems that integrate data, people, processes and systems for better decision making.

People: Customer relationship and Support, Location and tracking, Financial, etc. Processes: Remote monitoring, supply chain management, Security, Mobile devices and applications, etc.

A. *Functional View of IoT technologies*

Smart objects give major industries vital data they need to track inventory, manage machines, increase efficiency, save costs and possibly even lives. Name a household appliance, machine or other thing consumers use regularly- their car, an insulin pump, a washing machine.. any physical object. These devices when embedded with sensors and microprocessors are gaining the ability to sense their environment and communicate with computers or other intelligent equipment. And these intelligent "things" are sending signals and information without requiring human input. Designers are working to make devices more intelligent but also performing the vital task of ensuring the information is secure and can be reliably filtered and managed.

B. *Wearables*

One class of intelligent devices that stands to impact many consumers' daily lives is wearables. Wireless-enabled wearable devices have sensors tracking calorie burn, body mass index, or even sleep levels. Cloud-based wellness programs are interfacing back and forth with wearables, allowing for self-monitoring, management and data sharing with healthcare providers and others. Different types of devices comprise different types of networks that can communicate with a variety of applications over the Internet. These applications may have multiple interfaces. These device networks connect with the Internet and then communicate with the applications through a backhaul network. This backhaul network is the communications backbone of the Internet infrastructure.

C. *Internet of Things (IoT)*

The IoT connects devices such as everyday consumer objects and industrial equipments on to the network, enabling

information gathering and management of these devices via software to increase efficiency, enable new services or achieve other health, safety or environmental benefits. Fig.1 shows Intelligent Devices Communication in IoT.

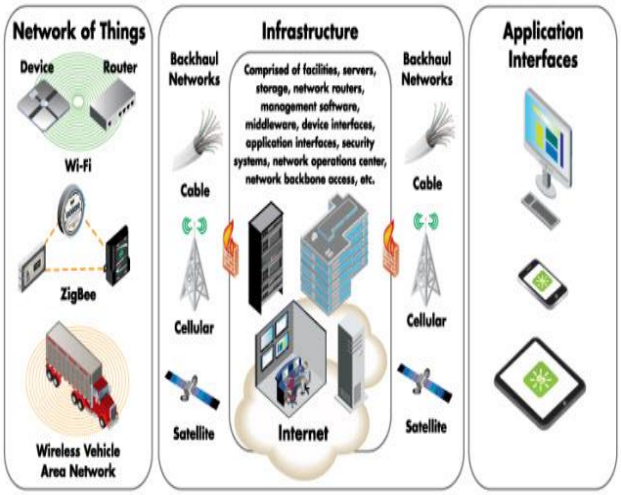

Fig.1: Intelligent Devices Communication in IoT
[Courtesy:http://www.mouser.com/applications/internet-of-things/]

II. LITERATURE SURVEY

[1] Andrea Zanella, Nicola Bui, Angelo Castellani,Lorenzo Vangelista, and Michele Zorzi, "Internet of Things for Smart Cities", IEEE IoTJ, Vol. 1, No. 1, FEB 2014.

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. In this paper, main focus specifically to an urban IoT system that, while still being quite a broad category, are characterized by their specific application domain. Urban IoT's, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This paper hence provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. Furthermore,the paper presents and discusses the technical solutions and best-practice guidelines adopted in the Padova Smart Cityproject, a proof-of-concept deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality.

[2] Oladayo Bello and Sherali Zeadally," Intelligent Device-to-Device Communication in the Internet of Things", IEEE system J, pp-1-11, Aug 2014.

Analogous to the way humans use the Internet, devices will be the main users in the Internet of Things (IoT) ecosystem. Therefore, device-to-device (D2D) communication is expected to be an intrinsic part of the IoT. Devices will communicate with each other autonomously without any centralized control and collaborate to gather, share, and forward information in a multihop manner. The ability to gather relevant information in real time is key to leveraging the value of the IoT as such information will be transformed into intelligence, which will facilitate the creation of intelligent environment. Ultimately, the quality of the information gathered depends on how smart the devices are.

[3] Jiong Jin, Jayavardhana Gubbi, Member,Slaven Marusic, and Marimuthu Palaniswami, "An Information Framework for Creating a Smart City Through Internet of Things", IEEE IoT J, Vol. 1, No. 2, APRIL 2014.

Increasing population density in urban centers demands adequate provision of services and infrastructure to meet the needs of city inhabitants, encompassing residents, workers, and visitors. The utilization of information and communications technologies to achieve this objective presents an opportunity for the development of smart cities, where city management and citizens are given access to a wealth of real-time information about the urban environment upon which to base decisions, actions, and future planning. This paper presents a framework for the realization of smart cities through the Internet of Things (IoT). The framework encompasses the complete urban information system, from the sensory level and networking support structure through to data management and Cloud-based integration of respective systems and services, and forms a transformational part of the existing cyber-physical system. This IoT vision for a smart city is applied to a noise mapping case study to illustrate a new method for existing operations that can be adapted for the enhancement and delivery of important city services.

[4] Li Da Xu, Wu He, Shancang Li"Internet of Things in Industries: A Survey" IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, November 2014.

It describes key enabling technologies in IoT system such as a) Identification and Tracking Technologies – RFID,WSN.b) Communication Technologies in IoT- Main communication protocols and standards includes RFID (e.g., ISO 18000 6c EPC class 1 Gen2), NFC, IEEE 802.11 (WLAN), IEEE 802.15.4 (ZigBee), IEEE 802.15.1 (Bluetooth), Multihop Wireless Sensor/Mesh Networks, IETF Low power Wireless Personal Area Networks (6LoWPAN), Machine to Machine (M2M), and traditional IP technologies such as IP,IPv6, etc.) Networks Involved in IoT- Ad Hoc Networks (AHNs) and WSNs.

III. PROPOSED SYSTEM

System Block diagram: Fig.2 shows the system block diagram for intelligent device to device communication with Wi-Fi using IoT. It mainly divided in two parts:

1. Hardware components
2. Software components

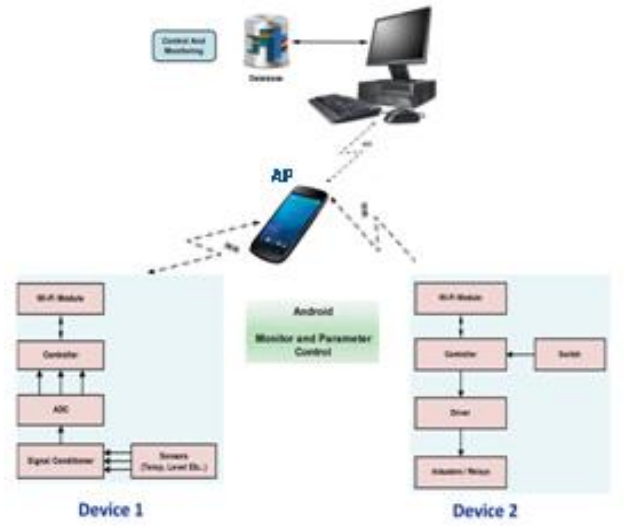

Fig 2: System block diagram of intelligent d2d communication with Wi-Fi using IoT

In the proposed system there are two devices are used which are communicating to each other through Wi-Fi module. In this system devices consist of different sensor interfacing such as dirt sensor, water level sensor, temp sensor. Both these devices are connected through Wi-Fi network protocol and we can control and monitor all the operations of these devices on our android phone as well as it can be observed on the laptop .Here two devices act as Wi-Fi client and requires access point because we want two Wi-Fi devices at a time. And laptop acts as a server. So, continuous human intervention is not required which is important part in IoT system. Such type of device to device communication is very useful for two interdependent systems in IoT environment.

A. Hardware components

1. Microcontroller

The AVR is a modified Harvard architecture 8-bit RISC single-chip microcontroller, which was developed by Atmel. ATmega32 is an 8-bit high performance microcontroller of Atmel's Mega AVR family. Atmega32 is based on enhanced RISC (Reduced Instruction Set Computing) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega32 can work on a maximum frequency of 16MHz.By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1MIPS per MHz allowing the system designed to optimize power consumption versus processing Speed.

2. Sensors interfaced

It mainly consist of three sensors interfaced:

a) Dirt sensor

Fig 3 shows the dirt sensor which consist of LED and LDR (10k) is used and then LM358 is used as a comparator and then given to ADC.

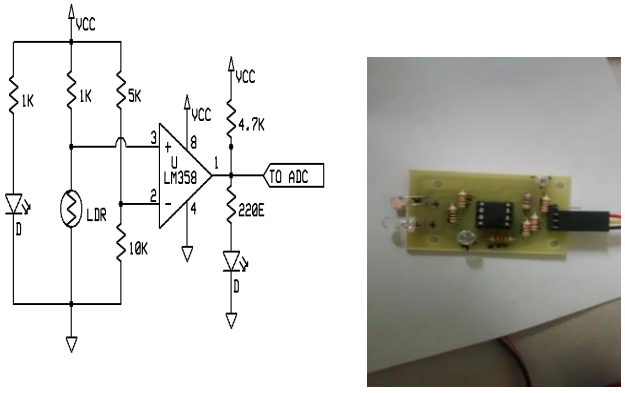

Fig.3 Dirt sensor

b) Temperature sensor

Temperature sensor used for temperature monitoring is LM35 temperature sensor**;** LM35 is a positive temperature sensor which sense temperatures from 0 degrees to 200 degrees.

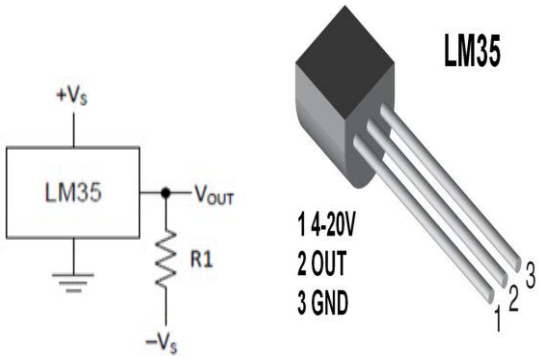

Fig 4: "LM35 Reference Diagram for Full range"

c) Water level sensor

Fig.5 shows water level sensor circuit used. Here SL100 transistor used as a switch working in base bias mode in which collector is connected to ADC and gnd as emitter and 220 ohm resistances are used in the circuit to show water level one ,two ,three and four levels.

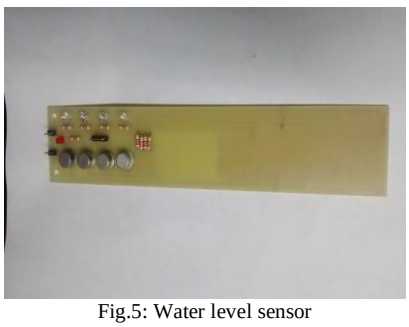

Fig.5: Water level sensor

3. Wi-Fi module

HLK-RM04 is a new low-cost embedded UART-ETH-WIFI module (serial port - Ethernet -Wireless network) developed by Shenzhen Hi-Link Electronic co., Ltd. This

product is an embedded module based on the universal serial interface network standard, built-in TCP / IP protocol stack, enabling the user serial port, Ethernet, wireless network (wifi) interface between the on versions. Through the HLK-RM04 module, the traditional serial devices do not need to change any configuration; data can be transmitted through the Internet network. Provide quick solutions for the user's serial devices to transfer data via Ethernet. Here, it is used as Wi-Fi client.

B. *Software components*

1. *Proteus*

Proteus 7 is used to show ADC window on hyper terminal and microcontroller with ULN 2803 interfacing also.

2. *MicroC pro for AVR*

MicroC Pro for AVR programs the microcontroller and AVR Flash is used to burn the code into chip.

3. *Eclipse*

Eclipse ADT. Eclipse is a multi-language software development environment comprising an integrated development environment (IDE) and an extensible plug-in system. It is written mostly in Java. Here, it is used to design an app for this system on Android.

4. *Language*

Java J2SE and JDK 6.1.16.

5. *Tomcat apache server version: 7.0*

Apache Tomcat is an open source servlet container developed by Apache Software Foundation (ASF). Tomcat implements the Java Servlet and the Java Server Pages (JSP) specifications from Sun Microsystems, and provides a "pure Java" HTTP web server environment for Java code to run.

6. *Android*

Android 4.2.2

7. *Database*

MySQL. MySQL is a database system used on the web. It is a database system that runs on a server. It is ideal for both small and large applications. It is very fast, reliable, and easy to use. It uses standard SQL. It compiles on a number of platforms. It is free to download and use. It is developed, distributed, and supported by Oracle Corporation. The data in a MySQL database are stored in tables. A table is a collection of related data, and it consists of columns and rows. Databases are useful for storing information categorically.Fig.6 shows database log of events.

Date	Device name	Threshold value	Current value	Status
2015-06-12 21:40:10.0	HEATER	16	11	ON
2015-06-12 21:40:13.0	HEATER	16	11	ON
2015-06-12 21:40:26.0	HEATER	16	12	ON
2015-06-12 21:40:31.0	HEATER	16	12	ON
2015-06-12 21:40:34.0	HEATER	16	12	ON
2015-06-12 21:46:01.0	HEATER	16	12	ON
2015-06-12 21:46:07.0	HEATER	16	12	ON
2015-06-12 21:46:10.0	HEATER	16	12	ON
2015-06-12 21:46:12.0	HEATER	16	12	ON
2015-06-14 21:08:39.0	HEATER	12	14	ON
2015-06-14 21:08:39.0	MOTOR	12	14	Waiting
2015-06-14 21:08:42.0	HEATER	12	15	ON
2015-06-14 21:08:42.0	MOTOR	12	15	Waiting
2015-06-14 21:08:45.0	HEATER	12	15	ON
2015-06-14 21:08:45.0	MOTOR	12	15	Waiting
2015-06-14 21:08:48.0	HEATER	12	15	ON
2015-06-14 21:08:48.0	MOTOR	12	15	Waiting
2015-06-14 21:08:51.0	HEATER	12	15	ON
2015-06-14 21:08:51.0	MOTOR	12	15	Waiting
2015-06-14 21:08:54.0	HEATER	12	15	ON
2015-06-14 21:08:54.0	MOTOR	12	15	Waiting
2015-06-14 21:08:57.0	HEATER	12	15	ON
2015-06-14 21:08:57.0	MOTOR	12	15	Waiting
2015-06-14 21:09:00.0	HEATER	12	15	ON
2015-06-14 21:09:00.0	MOTOR	12	15	Waiting
2015-06-14 21:09:03.0	HEATER	12	15	ON
2015-06-14 21:09:03.0	MOTOR	12	15	Waiting
2015-06-14 21:09:06.0	HEATER	12	14	ON

Fig.6: Database Log of Events

IV. RESULTS

A. *Simulation results window*

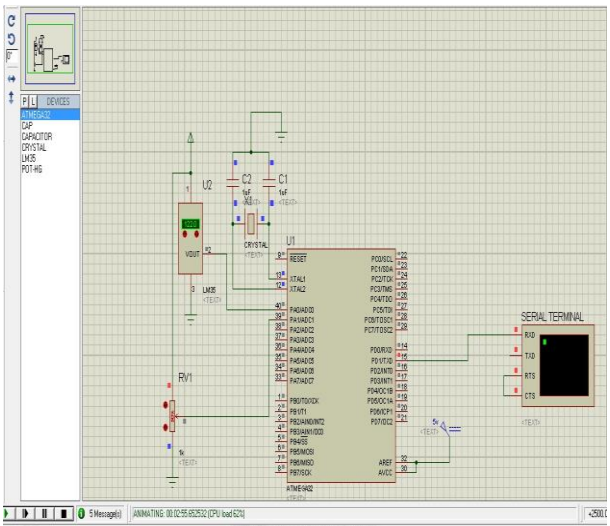

Fig.7 : Adc_UART simulation window

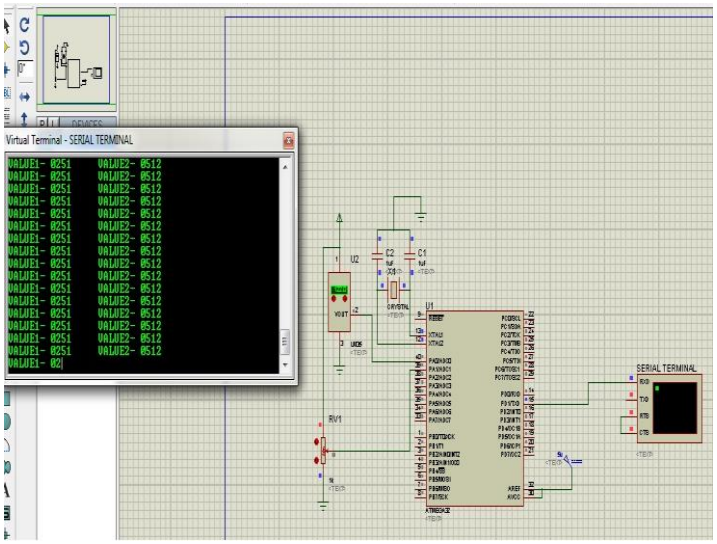

Fig.8: Simulation window of Adc_serial terminal

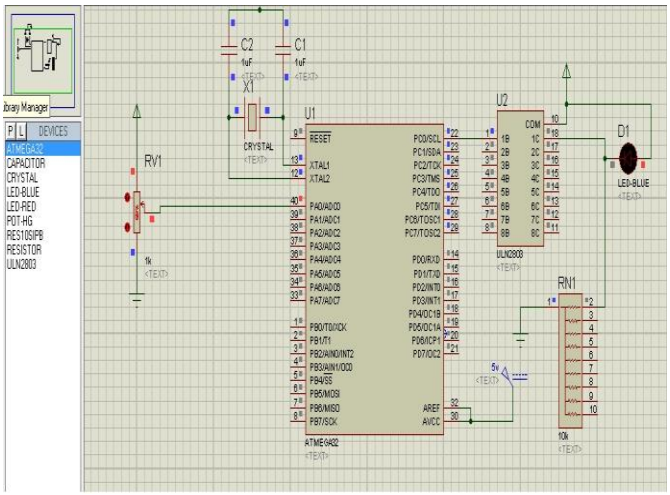

Fig.9: Simulation window of Avr_uln 2803

B. *Android application window*

Fig 10: Android application Window

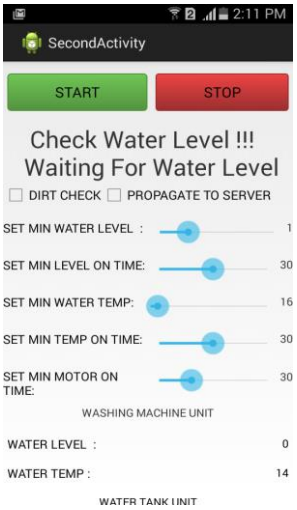

Fig.11: System checking for water level

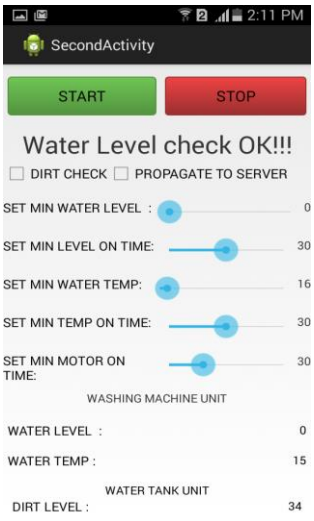

Fig.12: System with water Level check OK

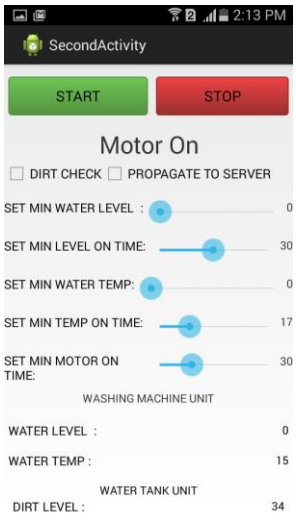

Fig.13: System for motor ON stage

V. CONCLUSION

Thus, the presented system describes a design and implementation of intelligent device to device communication with Wi-Fi in IoT. Here two devices are communicating to each other and share their data through IP which is important part in IoT system. This system eliminates the necessity of continuous human intervention in d2d communication. Here devices will independently take their decisions depending upon the requirements that these are self intelligent. Android application is designed for controlling and monitoring purpose. This android application developed for this system is useful to enhance the performance.The new concept of internet of things is also involved for that purpose.

VI. ACKNOWLEDGMENT

I would like to acknowledge all the people who have been of the help and assist me throughout my analysis of project work. It gives me a great pleasure in bringing out the project work entitled," INTELLIGENT DEVICE TO DEVICE COMMUNICATION WITH Wi-Fi USING IoT". It is observed outcome of the exciting work done under the inspiring guidance of my guide Mr.A.V.Walke.

VII. REFERENCES

[1] Oladayo Bello *and Sherali Zeadally,"* Intelligent Device-to-Device Communication in the Internet of Things", IEEE system J,pp-1 11, Aug 2014.

[2] Andrea Zanella, Nicola Bui, Angelo Castellani,Lorenzo Vangelista, and Michele Zorzi, Fellow,"Internet of Things for Smart Cities" IEEE IoTJ, Vol. 1, No. 1, FEB 2014.

[3] Li Da Xu (Senior Member, IEEE), Wu He, Shancang Li"Internet of Things in Industries: A Survey" IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, VOL. 10, NO. 4, NOVEMBER 2014.

[4] Evans, "The Internet of things: How the next evolution of the Internet is changing everything," Cisco IBSG, San Francisco, CA, USA, Apr. 2011
[5] X. Wang, Y. Ren, J. Zhao, Z. Guo, and R. Yao, "Comparison of IEEE 802.11e and IEEE 802.15.3 MAC," in Proc. IEEE CAS Symp. Emerging Technologies: Mobile & Wireless Commun, Shanghai, China, May, 2004, pp. 675-680.
[6] Baker, N. "ZigBee and Bluetooth: Strengths and weaknesses for industrial applications," IEEE Computing & Control Engineering, vol. 16, no. 2, pp. 20-25, April/May 2005.
[7] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," *Future Gener. Comput. Syst.*, vol. 29, no. 7, pp. 1645–1660, Sep. 2013.
[8] J. Buckley, "From RFID to the Internet of Things pervasivenetworked systems," Conference Centre Albert Borschette (CCAB), Brussels, Belgium, Mar. 2006. [Online]. Available: ftp://ftp.cordis.europa.eu/pub/ist/docs/ka4/au_conf670306_buckley_en.pdf
[9] Online: http://iotworldevent.com/infographic
[10] Online: http://www.mouser.com/applications/internet-of-Things
[11] Jiong Jin, Jayavardhana Gubbi, Member,Slaven Marusic, and Palaniswami, "An Information Framework for Creating a Smart City Through Internet of Things", IEEE IoT J, Vol. 1, No. 2, APRIL 2014