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Smart Home Automation Using Intelligent D2D Communication with IoT

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ABSTRACT

This paper gives clear and effective implementation for titled Smart Home Automation using Internet of Things to monitor regular domestic environment shows low cost ubiquitous sensing system. Includes brief description about integrated network architecture and mechanism for interconnecting reliable measurement of parameters using smart sensors and bit of data transmission via internet is been presented. In monitoring stage self-control mechanism provided by longitudinal learning system for better operation of the devices. System takes advantage of fluent Android application as User Interface equipped with web functionality as data interchanging and intelligent decision making. With duet making of software combines with cloud servers and IAAS, while the framework of monitoring system in base on combination of pervasive distributed sensing units, reasoning data aggregation & context awareness using information system. Resulting system records the reliability of sensing information transmission through the developed integrated network architecture is 98% also the prototype has been tested to generate realtime graphical information rather test bed scenario.

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I. INTRODUCTION

Since advancements in wireless sensor network (WSN), Internet technologies and a new trend in the era of ubiquity is being realized. Enormous increase in users of Smart phone mobile devices connected Internet and modifications on the internetworking technologies enable networking of everyday objects. IoT is all about physical items talking to each other, D2D communications and person-to-computer communications will be extended to "things". Key technologies are related to Smart sensor technologies including wireless sensor network, Nano-technology and Miniaturization in next step.

People usually inside home, interact with the environment pose as light, air, temperature etc., and regulate accordingly. So If the settings of the environment can be made to respond to human behavior or needs automatically, then there are several advantages. The automation of home settings to act according to the inhabitant requirement is termed as intelligent/smart home automation system. Ambient intelligence responds to the behavior of inhabitants in home and provides them with various facilities

Intelligent home automation system roughly consists of clusters of sensors, collecting different types of data from devices, regarding the residents and utility consumption at home.

II. SYSTEM DESCRIPTION

The device to device communicate over the Internet can be mechanized by following certain network architectural design strategies and applying ZigBee communication standards. The data transmission of smart sensing devices augmented with portal over the internet can be done by integrating an internet gateway with wnsZigBee network. In a network, end devices collect and forward data to a co-ordinator and then ZigBee protocol data format is translated to Internet protocol by the gateway.

The smart home automation scheme with d2d communication proposed here can distantly measure electrical parameters and control domestic objects. The unified system will assist the inhabitants to avoid multiple systems to monitor their domestic utilization. The system can be run with the help of an inhabitant favourite laptop or i-pad device or android mobile. Fig.1 shows the basic layout depicting key elements of the integrated wireless sensing network with internet system.

III. Implementation Details

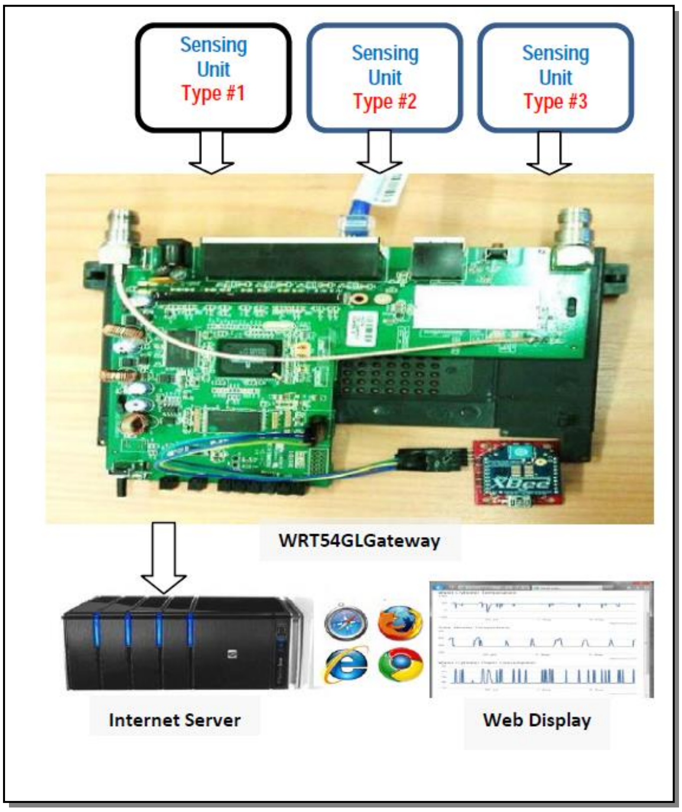

Fig 1: Overall System structure connecting different sensing units

A. Address Transformation

Figure contents the key element in the data transformation through ZigBee to IPV6 is the address translation. it determines the source or destination address of a packet that encapsulates this packets' payload, application gateway performs the address transformation mechanism for ZigBee to address non ZigBee nodes.

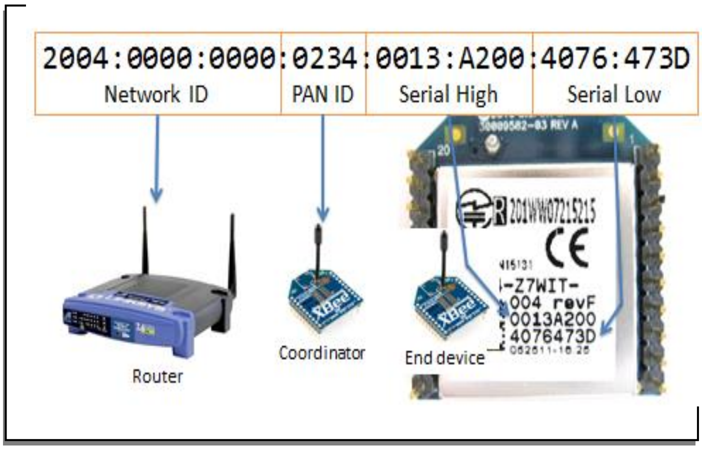

Fig. 2: Address transformation to Internet Packet

B. Packet translation

The packets originated from the XBeeS2 network sent to a server using tunnelling technique, where the addressing information is remove and place in the encapsulating protocol of the same. Packets destined for the XBeeS2 network uses a state_ful translation where the source address is stored on the gateway while this enables replying packets from the XBeeS2 network to be sent to the correct address.

A serial interface is used to transmit API packets from the coordinator and router. The WRT54GL router has two serial ports – one of which is used to connect to the XBee-S2 coordinator. XbeeS2 modules provide architecture to sample an analogue value and transmit a packet containing this sample to a coordinator. The coordinator outputs an API packet on its serial interface each time a sample packet is received. The API packet contains address of node that took the sample, the PAN ID of the network the node is on and the sample data.

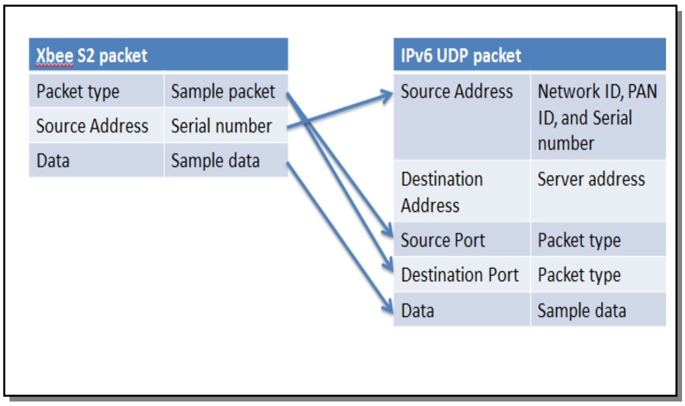

Fig. 3: ZigBee packet transformation (IPv6)

C. Transmission over IP

The Linux-Open WRT, TUN/TAP device driver acts as a virtual network device with its output directed to a user space program instead of a physical device, software provides the networking architecture to participate in many types of networks. This abstraction requires device drivers which operate in the kernel space, making development difficult. This simplifies the development of a network device, as a user space program is easier to develop. The IPv6 can be used with a TUNnTAP driver provided the kernel has IPv6 support. This means a virtual IPv6 network can be created, where packets destined for this network are routed to a user space program. IPv6 packets can also be created and sent via the TUNnTAP driver and will appear to originate from the virtual network.

D. Storage of data

An application running on the server uses the standard socket interface to receive UDP packets on an arbitrary port, and stores the relevant information in the MySQL database. The UDP packets produced at the gateway encapsulate sample data to be sent to windows based server. The database table has 4 columns; source address, time, source channel and sample data. In the present system, programs for address, packet transformations and data transmission are written using 'C' programming language, programs for packet reception and data storage are written using 'C#' and Web interface is developed using PHP and Java Scripts.

E. Network Monitoring

Important information for the setup of the system, deployment of the network, connectivity, health and reliability of the communication can be accessed from the developed Web user interface of the network. access to information about the actual network and the communications between the different elements of the network.

IV. LITERATURE SURVEY

Security:

a. The security features of WiFi and Bluetooth are much less robust than those used in public cellular systems. They would not be adequate for major public services and they would be unsuitable for public safety applications.

Independence from cellular networks:

b. WiFi and Bluetooth operate independently from cellular radio technology such as LTE. Any form of device-to-device discovery based on them would have to run in parallel with cellular radio operation, which would be inefficient and would become a significant drain on device batteries.

Unlicensed spectrum:

c. WiFi and Bluetooth operate in unlicensed spectrum, without any centralised control of usage or interference. This is not generally a problem when usage densities are low, but it would become a major limitation as proximity-based services proliferate. Throughput, range and reliability would all suffer.

Manual pairing:

WiFi and Bluetooth rely on manual pairing of devices to enable communication between them, which would be a serious stumbling block for autonomous, dynamic proximity-based services.

V. EXPERIMENTAL RESULTS

Tests are conducted by installing the Smart sensing units and setting up Wireless network, Interconnecting ZigBee network with IPv6 network is performed by connecting and configure & modified router Integrated system was continuously used and generated real-time graphical representation of the sensing information.

Fig. 6 a, b, c shows the graphical representation of type # 1 sensing unit information in real-time on the IoT website.

Measurements related to hot water and solar heating systems are shown in Fig. 6(a), Fig 6(b). Measurements of water supply pump are shown in Fig. 6(c). Thus, the hot water system of the household entities has been reflected in the form of IoT for better remote utilization and controlling through an internet website.

Fig. 6(a) shows temperature measurements From the graphs it is easy to determine when hot water was being used and the reduction in power consumption when the solar heater is active.

Fig. 6(b) shows temperature measurements taken outside the home and the approximate light intensity that the solar heater is subjected to. When compared with Fig. 6(a) it can be seen that when the light intensity and temperature outside the home is above a threshold the solar heater becomes active. Fig. 6(c) shows measurements of the voltage and current at the water supply pump.

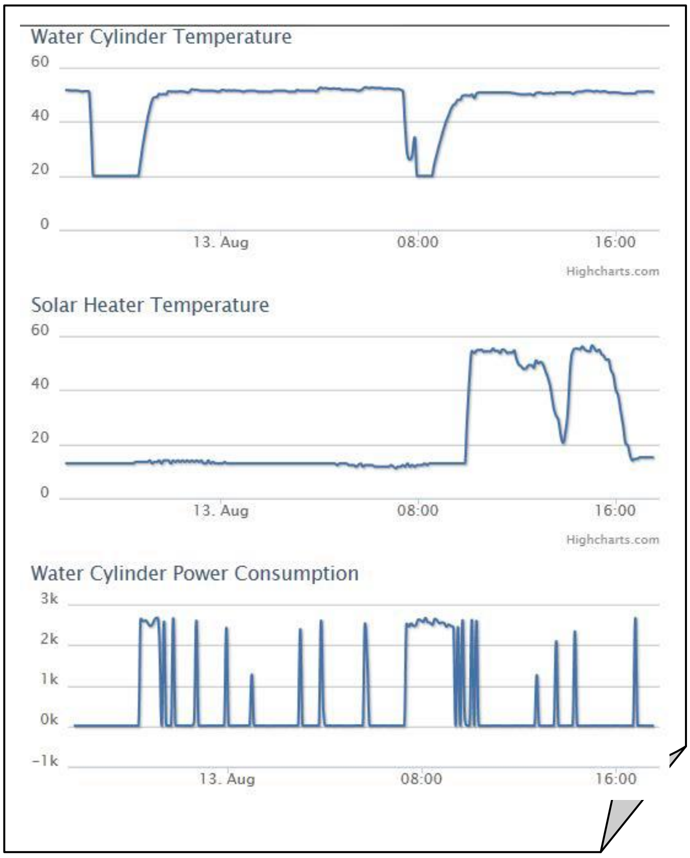

Fig. 6(a)

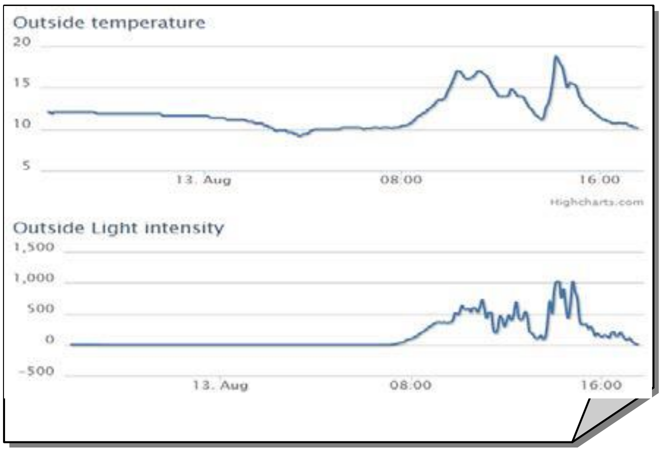

Fig. 6(b)

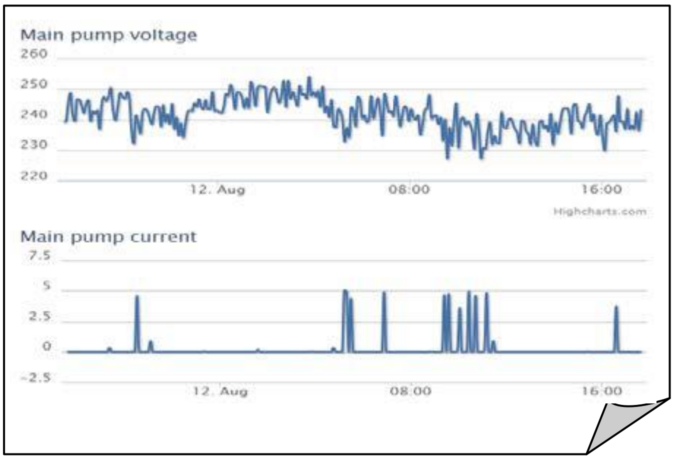

Fig. 6(c)

Above are : Real-time graphical representation of different types of sensing information on the IoT web site

(a) Sensing units inside the house, measuring hot water system parameters on the IoT website.

(b) Outside temperature and light intensity sensor data

(c)Voltage and Current measurement of water pump on the IoT web

VI. CONCLUSION

Thus D2D communication is an integral part of the IOT environment to design & deploy maintain a sustainable ecosystem. Some of the IoT research issues include energy efficiency, routing, security, context awareness protocols & many. In this paper, we focus on issues that will impact intelligent D2D communication in the IOT environment. We also analyzed state of art communication mechanisms in the licensed & unlicensed spectrum and routing techniques that will lead intelligent D2D communication. In addition, we discussed solutions to address these challenges.

A. Quality of Service (QoS) of the integrated ZigBee and IPv6 System:

The data from two sensors for the duration of a month was analysed to determine the reliability, throughput and jitter of the system. The time between these recorded times is the interval at which the XBee device is sending sample information. The total amount of sample information received by the server was calculated by dividing running time of the system with the sample interval.

Reliability: The difference between arrival times of successive sensor information gives the interval value. If the time interval is greater or less than 10 seconds then there was an error. When the interval is less than 10secs then the sample information received was incorrect or duplicated and therefore it is erroneous. When the interval is greater than 10secs sample information has been lost, the amount of information lost can be determined by dividing the greater interval by the expected interval. The reliability of the system was determined by comparing the calculated value with the amount of sensor information received correctly. The lost packets include the total of lost packets between sensing device-coordinator, coordinator-router and router-server.

However with the advancement in technology, it is expected that the availability of internet is everywhere and online at all time. Low-cost smart sensor node development enabled d2d be connected easily and corresponding information can be accessible globally. With the features of scalability, fault tolerance and effective power consumption of nodes and transceiver IoT have facilitated ubiquity computational ability to internetwork heterogeneous smart devices easily and facilitate availability of data anywhere. The QoS of the integrated network architecture is determined in terms of two parameters i) throughput and ii) reliability. The evaluation shows that the sensing information of the domestic object usages through IoT can be effectively realized.

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