Comparison and Analysis of Protocol parameters with enabled cloud computing services

Vijayasaro.V [1*], Niveathasaro.V [2]

[1*] Research Scholar, Department of Electronics and Communication Engineering, PRIST University, Thanjavur, India-613403.

[2]Assistant professor, Department of Electronics and Communication Engineering, Mahath Amma institute of Engineering and Technology, Pudukkottai, India-622001.

*Corresponding Author

ABSTRACT

Wireless sensor networks play the prominent role in modern communication world. The emerging scarcity of electricity for posterity causes revolution in safeguarding the energy sources. On the global scale, demand of electricity has been increasing vastly. IoT is an exquisite telecommunication, with the admirable aspect of cloud computing services. We propose the fusion of nRF based Wireless Mesh Network and Bluetooth Low Energy in the Physical layer. In this paper, we demonstrate a model for the data management between various protocols in real time application.

Key words:

Wireless sensor networks, cloud computing services, Wireless Mesh Network and Bluetooth Low Energy, real time application.

1. Introduction

The notion of internet of things was mainly framed by the Ashton exemplify the influence of connecting Radio-Frequency Identification (RFID) that can be incorporated in various supply chain management to the internet for reducing the intervention of humans in terms of counting and tracking properties [1]. The main target of this paper is to maintain, monitor and control the usage of electricity by the users. Electricity is the one of the predominant economy of the country. Energy can be used in various fields such as domestic, industries, Commercial end users. The internet of things also focuses on establishing a communication between machine to machine and also it enhances the individual person to computer communications [7], [9]. According the projections of 2025 the nodes of the internet of things will connect many things that are primarily used in our routine life. The internet of things may also be used to monitor the health status of animals besides measuring the health conditions in human beings. Different engineering structures are also measured and monitored by using the applications of internet of things [7]. The user needs good accuracy in measurement and service, reduce tampering of current and give details about current consumed by each load at short regular period of interval. The development of intelligence and automation intends human to live in a sophisticated environment. The concept of smart grid is related to the information and control and the main purpose of it is to manage the energy in an efficient way [10]. The real time two way communications between the providers and the users is well established by using the information and communication technologies there by generating more energetic interaction on flow of energy which further improves the sustainability and the efficient use of power [11]. Three developed protocols comparison developed from the methodology has been demonstrated for environmental monitoring application. IoT rises as new stage for purchaser hardware keep on achieving execution regarding the force and usefulness and it also decrease the cost of the framework. In the latest scientific era the evolving technology in the field of electronics are embedded systems and wireless sensor network respectively. From the analysis they compare the parameters such as power consumption, network design flexibility, and complexity[3].

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Fig. 1 Smart Grid Applications

Nowadays the internet of things has become the most acceptable medium for explaining the situations in which the internet connectivity and computing capability plays a pivotal role in wide range of objects, devices, sensors and several other things that are part of our day to day life. The Internet of things is a quite new emerging technology that combines computers and networks for monitoring and controlling devices around us. The remote based monitoring meters on the electric grid through the telephone lines is one of the classical examples that were used commercially since late 1970s [2]. Integration of sensors, microcontroller and wireless protocols are optimally possible with the help of internet of things by which the physical device can be connected to the internet [4]. The internet of things also focuses on establishing a communication between machine to machine and also it enhances the individual person to computer communications [6].

2. Basic concept of Energy Flow:

The energy consumption is sensed and monitored that is the most important crucial element of the information and communication technologies. Nowadays there is wide use of digital communication technology through which the data can be transmitted across the network. Smart homes are having the concept of smart meters which provides concurrent information about the power consumption. It is also used to coordinate, control and to automate the system by which the data can be processed and extremely interactive electricity can be generated [12].

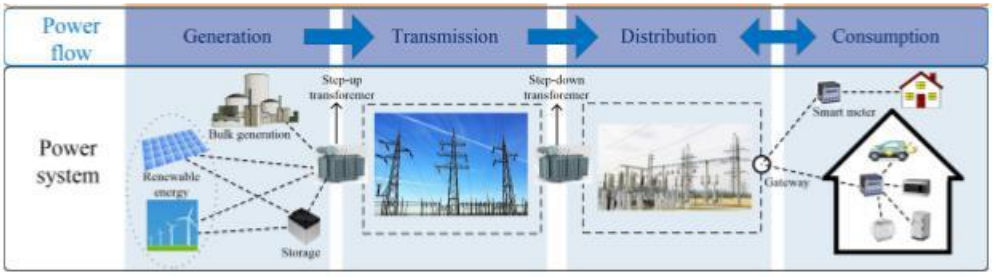

Fig. 2 Energy grid flow

The energy grid mainly consists of four functions such as power generation, Transmission, Distribution and consumption.

To rescue the problems in basic energy grid is one way communication, wastage of energy, we intends intragrid developed by IOT significance is a two way communications. The major problem faced by traditional energy grid is aging infra-structure. IoT merge the statistics, energy undertaken and delivering of current consumed by each load and reach the data to user. The primary work of IoT is divided into three parts such as utilize sensors for monitoring the parameters, updating the data with the help communication technologies and

modulate the usage of energy resources for modernization of energy grid.

3. Comparison between traditional energy grid and intragrid

With respect to [17] in general point of view intelligent grid can be classified into five major parts. They are sensing and measurement unit, intelligent scaling of energy consumed, phasor measurement section for each variable, infrastructure for communication and additional components for integrating every component. The evolution of smart grid teaches the consumer to give awareness about energy usage and by using the data the customer can control the usage at peak hours and save their economy. The traditional grid has drawbacks such as insecurely connection within the grid. Even though energy created by renewable and non-renewable resources, the consumer usage of electricity keep on increasing exponentially cannot satisfy need of resources. So to obtain the secure and reliable resources, we have to use efficient real time communication.

Traditional power grids are being transformed to innovative Grids (SGs) to solve the problems of one way communication, avoid wastage of energy, increasing demand of energy, providing reliability and improve security. Our proposed grid communicates server and user in bidirectional way involving the important functions of grid such power generation, transmission, distribution and utilization systems. With the help of internet of things our grid performs the monitor, analysis and control of energy in the grid.

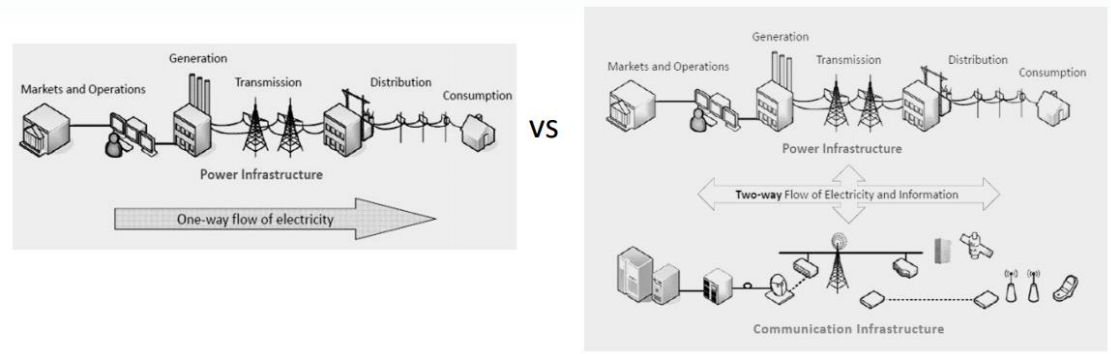

Fig. 3 Difference between traditional grid and proposed grid

Some of the applications of intelligent grid are Automation of energy transmission and distribution, utilization of energy is modernized and optimized, can reach the usage of electricity to consumer, efficient management systems. The main functions of intragrid providing current consumption with high end flexibility and consistency with data analyses. By using this method user can save energy consumption and money for electricity bill by using management system. This method mainly intends for reduce manual strength and to evade manual error while apprising the current consumption for the user.

4. Interfacing Block diagram for the Sensors and protocols:

This section describes about the block diagram for IOT based smart energy grid. IOT have capability to interconnect billions of sensors for data collection. The Current world is facing too much of energy crisis and the best solution for addressing this problem is carried out by monitoring and controlling the power consumption. We need to have a relevant system for reducing the power usages in the households. The number of consumers of the electricity is increasing day by day and thus there is need for requirement of more energy which alarm us to reduce the energy losses. For saving more energy it is highly recommended to monitor the power consumption losses so that the generated power can be utilized in an appropriate way. There is need for an advanced technology for minimizing the loss of energy. In the current trend we are having such a high end technology named IOT ie internet of things and by using it the objects can be controlled remotely in the existing network infrastructure with the help of sensors [19]. The internet of things process the information in an innovative way through the acquisition technology which is also known as the third wave information technology [20]. Nowadays the most effective method for managing the power consumption is internet of things based power management system and the internet protocol enable service is one of the best evident systems for saving energy. IOT based systems are relatively cheaper to implement but it is not a cost effective one

because of the requirement of multiple sensors. The IOT based system requires unique sensors to control the power consumption. As a result of advanced technology it is now possible to use fewer sensors in one platform consuming both the energy and the power. Internet of things acts as a main communication between the energy meter and the web server and the sensors plays a vital role in collecting the data from the load and the energy meter and it send it to Microcontroller.

The project was done by using ATMEGA328 microcontroller as a heart of the processor. It belongs to Arduino family. It needs advanced version of embedded C for programming. The BCM2387 boards act as gateway in the system. AC712 sensor is used for acquiring current value and sends data to microcontroller. LM35 sensor used to check how much heat obtained from the electrical load. The flame sensor in this module indicates an alarm to user if fire or sparks emit from electrical load. The focus of this project on designing a low cost, high security energy grid and analyzing four using wireless protocols such as nRF, HTTP, BLE, UDP. In software section we used Arduino IDE platform for Arduino controller, Python Software used for Rasberry pi. Matlab Software is need for data analysis. The Cloud Platform (thing speak) is needed for sending sense data to the cloud. Five wireless nodes were used in this research. Each node consists of sensor or actuators for interface that provides solution in a unique way.

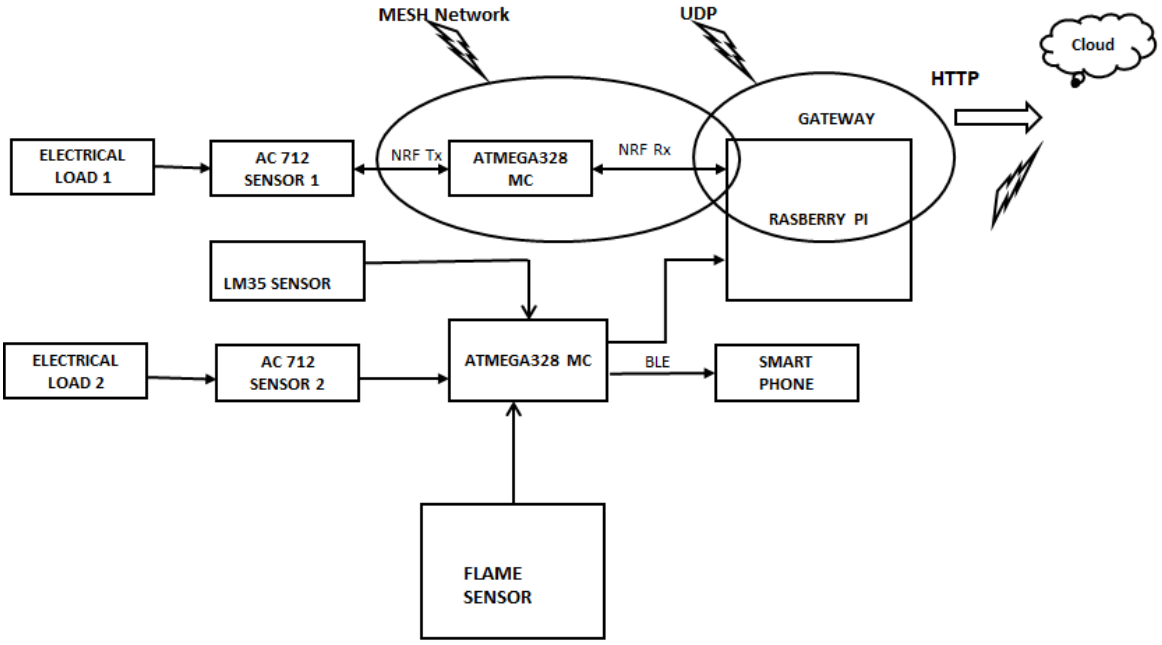

Fig. 4 Block diagram

The five wireless nodes are mentioned below:

Node1: wireless mesh network Transmission
Node2: wireless mesh network Reception
Node 3: Bluetooth Transmission
Node 4: UDP in Gateway
Node 5: Wifi (HTTP) to the cloud

Depend on the nodes deployed in the existing system provides efficient communication to the application layer. Wireless sensor communication provides advantage to facilitate exploration to all the fields of application. Wireless mesh network module is demonstrated with the help of nRF protocol. Each protocol requires its own specific characteristics for data transmission.

5. Results and Discussions

In this chapter we discuss basic parameter from its nature and test case. IoT has lot of applications from various sensors. We used AC712 current sensor in the physical for the Comparison of protocols and to reduce the usage of electricity.

Table 1: Comparative Analysis between Wireless Protocols

No.	Parameters	UDP	HTTP	Bluetooth	nRF
1	Basic Cell	-	Piconet	Piconet	star
2	Maximum signal Rate	110Mbps	54Mbps	720kbps	720kbps
3	Nominal range	100 meters based on modem	100 meters based on modem	Approx. 10 meter	Approx. 10 meter
4	Frequency bandwidth	5 to 10 GHZ	5 to 10 GHZ	2.4GHZ	2.4GHZ
5	Total No of packets	65,535 bytes	479 bytes	5	16
6	Packet loss	320 bytes	Loss will be based on cloud	50ms-1% loss µs-50%	50ms-50% loss
7	Packet delivery ratio= Packet send/Total no of packets	650/1024	850/1024	1000/1024(ACK based)	1000/1024(ACK based)
8	Wake up time	Not Available	Not Available	100 us	100ms
9	Data Acceptance time	Based on cloud	Based on cloud	5 us	50mS
10	Data protection	16 bit CRC	32 bit CRC	16 bit CRC	8/16 bit CRC
11	Modulation type	Based on layers	BPSK, QPSK, OFDM, MQAM	GFSK, CPFSK, 8-DPSK, π/4DQPSK	GFSK
12	1ongitivity	~7 year	~7 year	~2 year	~1 year
13	Expected traffic cost	NN	NN	450	250
14	Average Hops	3	6	8	16
			Under my test case		

The data carried out in the tabular column provides comparative statement various parameter and characteristics between the four protocols used in the research is mentioned. Under the test case, the data is enclosed in the table. By using factors such as security, reliability, Cost for purchase and installation the data is furnished in the table. The various wireless technologies existing in one application exchange the sensor data for various locations. The main contribution of IoT provides human excellent opportunity with the help of sensor that indent for monitoring and sensing the parameters.

6. Case studies

The case study developed for energy saving technique and brief comparison between the IoT connected electrical appliances and non IoT devices. In this case study connected device in the home will give the data of consumed power over the time where we can monitor remotely.

6.1. Case study

1 CFL Light: (Avg. 14 watts/Hour)

Fig. 5 Power consumption by electrical bulb per week

6.2. Case Study

1 Fan (Avg. 70 watts/Hour)

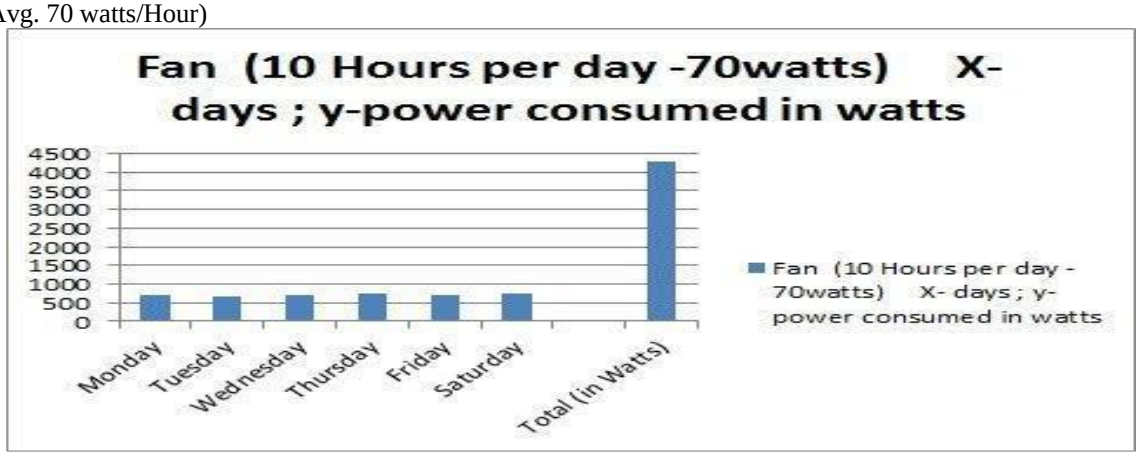

Fig. 6 Power consumption by electrical fan per week

7. Conclusion

The whole system depends on analysis done ensures better result due to nodes deployment. We use the capability of low power design on embedded chip to save battery life. Technology is gaining much attention from researchers from both industry and academia. The growth of the technology shows significant impact on human lifestyle that initiates to integrate WSN and IoT technology. The next generation of technology is almost ready to reap the benefits of controlling networks with a unified control protocol almost in every technological domain. Furthermore, the reduction in the number of transmissions can support WSNs to admit more sensor nodes, increasing their range and generating more knowledge about the monitored area. Due to the coordination of node, the number of viable connection in the network, and the strength of the connections illustrated.

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Vijayaregunathan Vijayasaro is currently a Ph.D. Research Scholar at the Department of Information and Communication Engineering, PRIST University, Thanjavur. She earned her ME in Embedded System Technologies from Anna University of Technology, Coimbatore. She completed her BE in Electronics and Communication Engineering from Sudharsan Engineering College Pudukkottai. She worked as a Teaching Fellow in Electrical and Electronics Engineering Department of Anna University, College of Engineering, Gunidy, Chennai from 18th July to till 30th November 2014. She was as an Assistant Professor in Electronics and Communication Engineering Department at Sudharsan Engineering College, Pudukkottai from 1st June 2012 to till 31st May 2013. She has published 8 research papers in reputed journals with high impact factor.

Vijayaregunathan Niveathasaro is currently working as an assistant professor at the Department of Electronics and Communication Engineering, Mahath Amma Institute of Engineering and Technology, Pudukkottai from. She earned her ME in Applied Electronics from JJ College of Engineering and Technology, Trichy. She completed her BE in Electronics and Communication Engineering from Sudharsan Engineering College Pudukkottai. She has published 7 research papers in reputed journals with high impact factor.