

Implementation of Data Transfer in Microgrid and HEMS using Zigbee

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Abstract—ZIGBEE based wireless data communication is presented for Microgrid in this paper. This proposed communication system is responsible for transmitting and receiving data between the controllers in the Microgrid. The data which is needed are defined and a suitable coding is proposed. Since Zigbee is a low power consumption, low cost device. It can be used for energy conservation in Home Energy Management System (HEMS) which is presented as an application of Zigbee. If the power generated in the grid is managed efficiently and distributed effectively, it will reduce the power consumption

Keywords—Communication System, Microgrid, HEMS, Zigbee.component

I. INTRODUCTION

Power Supply systems especially in the Public sector are still designed according to the old standards of reliability and they do not take the advantage of latest technological developments. However to adapt the recent technologies and techniques allowing significant cost advantage with Environmental acceptance, the latest Zigbee method of data transfer is utilized.

This ensures faster transmission of data. Natural resources are utilized for power generation leading to no emission and low cost. The use of Zigbee provides an easy to install reliable, self configuring, self healing network and Interoperability. Zigbee is an acknowledgement based protocol and will resend message if no acknowledgment is received [10].

A Microgrid is a small scale power supply network that is designed to provide power for a small community [1]. It enables load power generation for local loads. It consists of central controllers and Local controllers. To transmit the data between these controllers, a reliable communication system is needed. So we go for Zigbee wireless technology. A typical Microgrid system is shown in Fig.1

The Microgrid operates in two modes. Grid connected mode & Island mode.

Grid connected mode:

- Utility grid is active
- Static switch is closed
- All feeders are being supplied by Utility grid

Island mode:

- Utility grid is not supplying power
- Static switch is closed.

Need for Microgrid: Transmission losses gets highly reduced. Microgrid provides high quality and reliable energy

supply to critical loads. CO2 emissions are reduced. The size of the Microgrid is limited to a few MVA. For larger loads Microgrids can be interconnected to form a larger micro grid network called Power perks. Using Zigbee in this Microgrid leads to energy conservation. HEMS (Home energy management system) is used to save the energy from home application by using Solar panels and wind turbine [6]. We use the Zigbee based HEMS integrated with wifi. I.e. to take the electrical readings such as energy consumption from home applications. Zigbee is used as a Transmitter and Receiver.

Wired and wireless technologies can be used in Microgrid. Wired technologies are RS232, Powerline communication, Ethernet. Wireless communications are Wifi, Wimax, Zigbee, Zee wave, Bluetooth, Instion

We go for wireless zigbee in this paper, because of its low installation cost and it is apt for the remote areas. Inside the Microgrid, there will be numerous meters, sensors and actuators which we need to be monitored and controlled. So Zigbee based wireless is more efficient in the aspect of installation cost. Zigbee technology is a low data rate, low power consumption, low cost, wireless network protocol. It is easy to install.

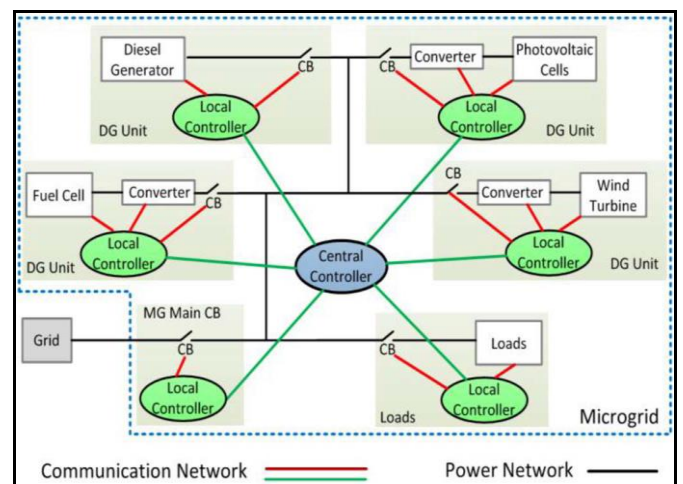


Fig.1: A typical Microgrid system

The IEE 802.15.4 Committee started working on a low data standard. It can transmit to a distance of 10 to 75 mtr maximum. The data rate is 250kbps at 2.4 GHz, 40Kbps at 915 MHz, 20Kbps at 866 MHz. It has two layers PHY and MAC. Which works on three topologies. Viz., Star, Mesh and Cluster tree. Its architecture consists of three layers Application layer, Physical layer and Mac layer. There are three Zigbee device types viz., Zigbee coordinator node, Full

function device (FFD) and Reduced Function device (RFD) as shown in Fig.2.[9].

Full function Device: It can operate on all topologies. It can also act as a coordinator.

Reduced function Device: It is capable of talking in the network. Has less memory, It talks only to the n/w coordinator.

There are two types of communication mechanisms in Zigbee. Viz., Communication to a coordinator in a Beacon enabled network and Communication to a coordinator in a NonBeacon enabled network as shown in the Fig.3

II. SYSTEM ARCHITECHTURE

Fig.4 represents a system hardware architecture for data transfer. Energy from natural resources are extracted and stored in Batteries from where it is given to various DGs (Distributed Generators). Here Zigbee technology is used to distribute the data between the controllers, from which it is connected to the Micro controller. The microcontroller is connected to a Relay system which distributes the power to various loads attached & displayed in the LCD. The advantage of this paper is the usage of naturally available resources alone. The power generated from the natural resources are efficiently used for home appliances.

The Block diagram is a system hardware architecture for data transfer. Energy from natural resources are extracted and stored in Batteries from where it is given to various DGs (Distributed Generators). Here Zigbee technology is used to distribute the data between the controllers, from which it is connected to the Micro controller. The microcontroller is connected to a Relay system which distributes the power to various loads attached & displayed in the LCD. The advantage of this paper is the usage of naturally available resources alone.

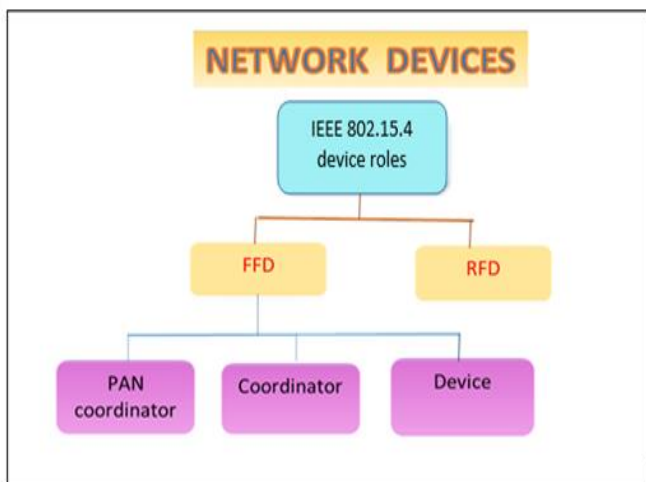


Fig.2: Network Devices in Zigbee

The power generated from the natural resources are efficiently used for home appliances.

III. SOFTWARE IMPLEMENTATION

Embedded C, Keil μ Vision4 Simulator as shown in Fig.5 is used for implementing the above Zigbee data transfer. This software features μ Vision Debugger providing a single environment to test, verify, and optimize application code. The debugger includes traditional features like simple, complex breakpoints, watch windows, execution control and full visibility to device peripheral.

IV. CONCLUSION

Zigbee based wireless data communication is presented in this paper. This system is responsible for transmitting the electrical parameters from the local controller of every Distributed Generation to the Microgrid. The power generated by the natural resources are effectively utilized for home appliances, thereby human effort and power wastage can be minimized. Consistent power availability is ensured by any one of the multiple resources.

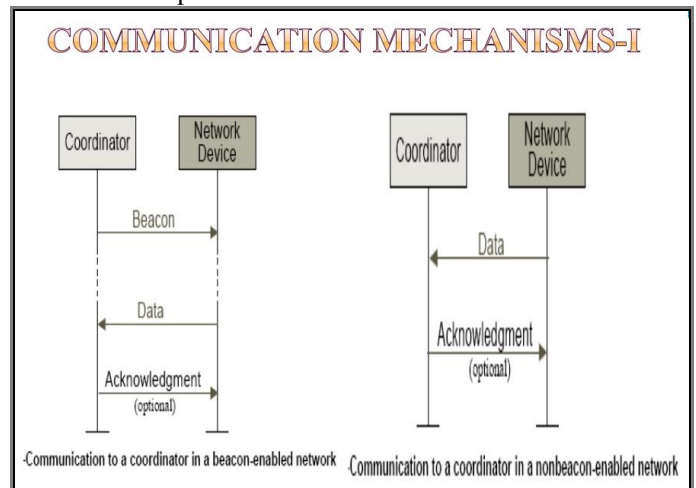


Fig.3: Communication mechanisms in Zigbee

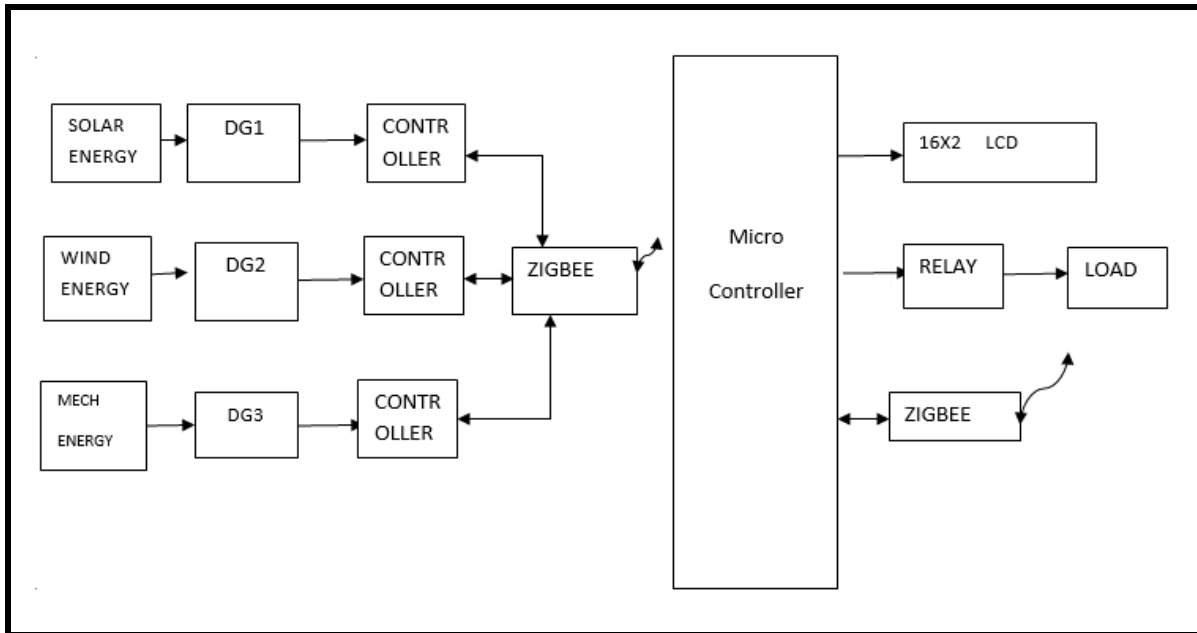


Fig.4: Block Diagram

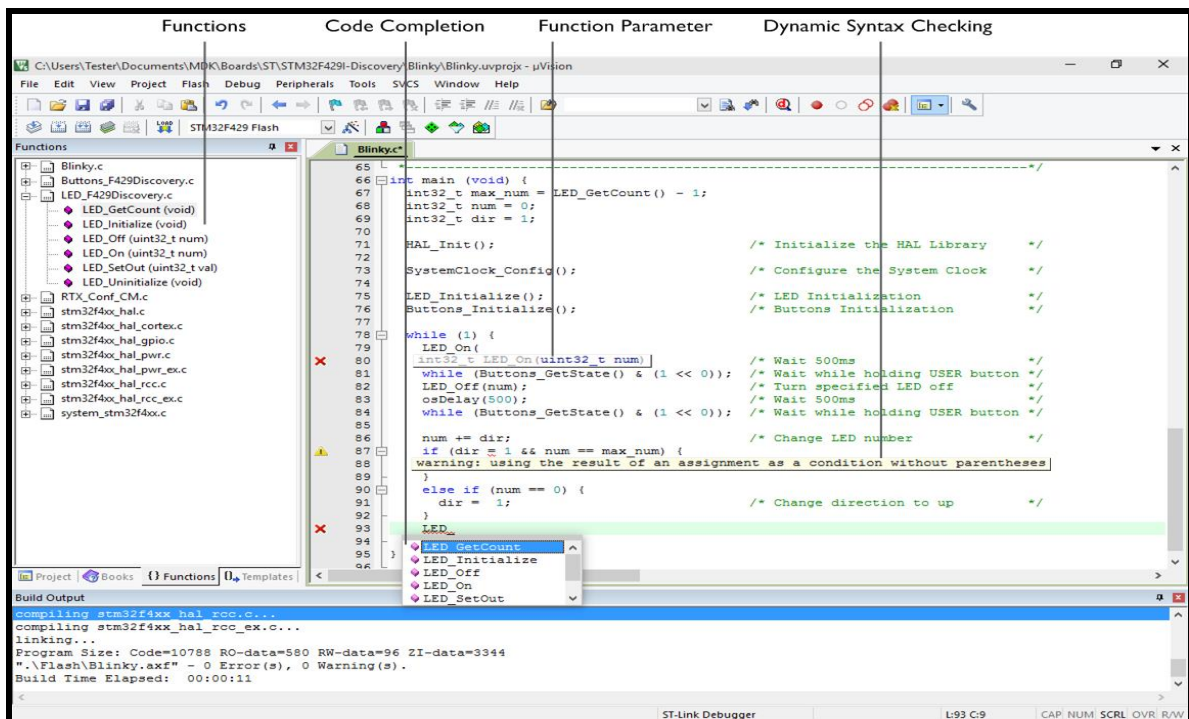


Fig.5: Keil µ Vision4 Software Simulator

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