

An Approach to Implement Low Power Using Bluetooth Low Energy (BLE) and Zigbee on Single Platform

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ABSTRACT: Internet of Things (IoT) has been raising technology in the recent world. Even though there are number of systems which strive to put up best of it, power consumption and the real time data transmission has become the crucial issues when it comes to battery operated systems. The main industrial challenge is to come up with a low power operable system which makes use of recent technologies to have the capability to communicate to other devices. The study was done on the technologies used in fulfilling this target and the efficient approach to implement low power Internet of Things (IoT) using both ZigBee and Bluetooth standards on single board providing the flexibility to select the medium of communication or existence on single platform is presented.

KEYWORDS: Internet of Things (IoT), ZigBee, Bluetooth

I. INTRODUCTION

In recent days, the demand for intelligent systems has been rising in all the domains like automobiles, home appliances, security etc. A world of intelligent systems can be created by the technology commonly called Internet of Things (IoT). IoT is the network of devices that are referred as things, connected to the internet and has the connectivity to communicate with each other. It brings up a platform to connect wide range of devices regardless of company by which they were manufactured.

Many IoT technology based projects have been carried out to serve the requirements of users for the better approach and to build the efficient device from long time now. The key challenges like size, power, security etc. that are to be fulfilled create the need for better approach compared to IoT technologies present in the market now. One of the main challenges in today's world is power. For instance, the expectation of battery life time for the wearable applications is such that people wants the power to retain for weeks and months. In this paper, the use of Bluetooth Low Energy (BLE) and ZigBee PRO on the same board for efficient battery use and user friendliness is demonstrated.

II. COMMUNICATION BACKGROUND

WIRED COMMUNICATION

The wired communication refers to the communication through the cables. This is the traditional type of communication, where the devices that are to be communicated are connected to each other using cables on which data are transmitted. The cable charges can be more if damaged, and also it becomes difficult to make portable systems. Hence the wireless communication is preferred in recent systems.

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WIRELESS COMMUNICATION

Wireless mode provides mobility and possibility to move the devices to places. Since there are no cables involved as much as in wired communication, this mode helps to reduce the complexity of installation and cost. Once the radios are installed, the user can monitor these points easily.

III. WIRELESS TECHNOLOGIES

There are various wireless technologies for the communication like Wireless Fidelity (Wi-Fi), ZigBee, IPV6 Low Personal Area Network (6LowPAN), WiMAX, Bluetooth etc. Due to the adaptability, availability and complexity issues, most abundantly used technologies are Wi-Fi, ZigBee and Bluetooth. The characteristic study of Wi-Fi, ZigBee and Bluetooth shows the efficient technology that can be used. The comparison table for ZigBee, Bluetooth and Wi-Fi are as shown in the Table 1. Bluetooth and ZigBee are preferred than Wi-Fi based on cost effectiveness and power consumption. Various Bluetooth and ZigBee standards are available for the communication purpose. Depending on the requirement, suitable standards of Bluetooth and ZigBee are selected.

Table 1: ZigBee, Bluetooth and Wi-Fi comparison

Technology	ZigBee	Bluetooth (BLE)	Wi-Fi
Operating frequency	2.4GHz, 915MHz, 868MHz	2.4GHz	2.4GHz, 5Ghz
Range	~300m	~10m	~100m
Data rate	250Kbps	1Mbps	600Mbps
Nodes	65,536	8	32
Power	Very low	Low	High
Network architecture	Star, Tree, Mesh	Star	Star
Application focus	Monitoring, Control	cable replacement	Web, email, video
Key applications	Building automation, Commercial and industrial	Health and fitness	Residential and commercial

BLUETOOTH

There are multiple Bluetooth specifications available in the market. Out of which, ultra-low power Bluetooth devices is identified-which consumes less standby power and can operate using coin cell battery. The classic Bluetooth is used to send audio, video and files. Due to continuous transfer of the data, there would be more usage of power. This continuous transfer is not necessarily needed for our IoT application. In the applications like heart rate monitoring and fitness monitoring, where the job is simple and specific, the necessity would be to send these data to the device.

An alternate Bluetooth specification BLE (Bluetooth low energy) was selected instead which can be used to simply send the specific type of information, so that the power consumption can be reduced. This specification of the Bluetooth is also called as Bluetooth smart. Bluetooth smart will have the capability to send the brief bursts of data rather than continuous operation as in devices like wireless headsets. With the introduction of the BLE, communication between the devices can occur for weeks or months or maybe even for years using a coin cell battery due to reduced power consumption.

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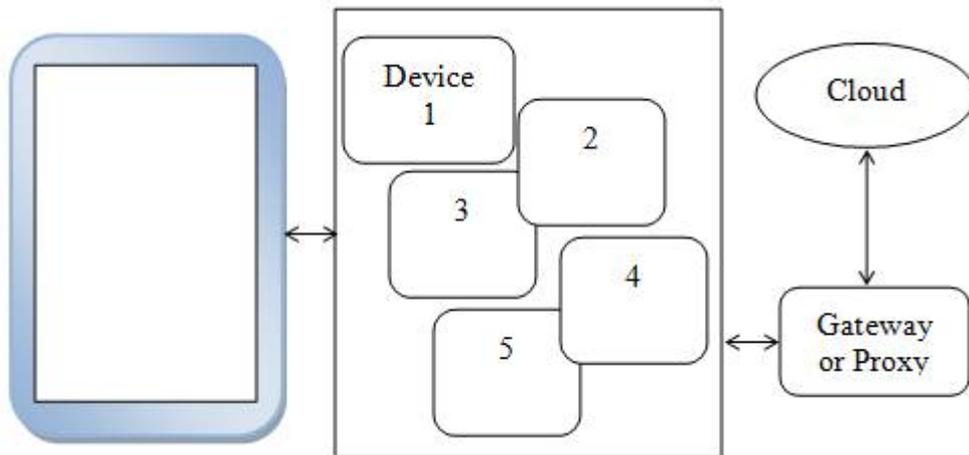


Figure 1: Bluetooth networking

ZIGBEE

ZigBee is widely used technology by the industries for connectivity. The ZigBee operates on IEEE 802.15.4 physical radio specification operating on frequency bands including 2.4GHz, 900MHz and 868MHz providing extendable network topologies. ZigBee also provides low power, wireless connectivity to wide range of devices. They are capable to co-exist with other technologies.

ZigBee PRO is enhanced version of original ZigBee version that has enhanced extra features which can be used in large networks. It is low power protocol that provides wireless connectivity for applications based on wide range of networking. The transfer of data is packet based. It provides flexible, greatly extendable network topologies with intelligent routing capability. Listen-before-talk and other security measures incorporated make them co-exist with other wireless technologies. The protocol supports the nodes to allow some devices to be put into power-saving mode when they are not active. Thus, the network can be battery powered and can be self-contained.

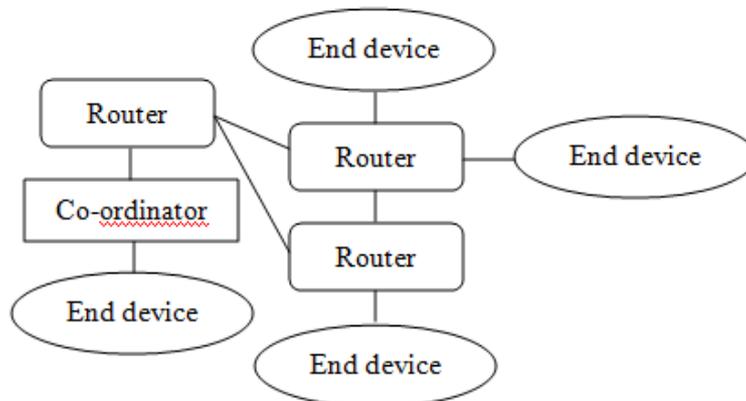


Figure 2: ZigBee networking

IV. BLE AND ZIGBEE ON SINGLE PLATFORM

Both Bluetooth and ZigBee have their own use cases. Bluetooth works as Personal Area Network (PAN) that can be used in the applications in which it is connected to a group of devices and communicates with the limited devices and updates the user. ZigBee works as Local Area Network (LAN) that is emphasised where the devices respond to the user specifically in home automation applications. In most of the smart home applications, BLE and ZigBee both

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complement each other. For instance, a door lock mechanism can be controlled by a smartphone through BLE or by internet through ZigBee stacks. Thus, an efficient system can be obtained if both of these technologies co-exist to make the system more efficient and user-friendly.

A platform which is single and open for several technologies is a new trend in the world of IoT. Some of the basic building blocks of BLE and ZigBee like RF, 6LowPAN, encryption, and modem are similar for both. Since both use similar radio and modulation, they will not cost huge even with the use of both at a time. The GMSK and QPSK modulation schemes used by BLE and ZigBee respectively are similar to each other. QPSK is similar to GMSK without the Gaussian shaping filter. AES-based encryption accelerators are also used by both BLE and ZigBee. TI's SimpleLink CC2650 and Freescale's KW40Z wireless MCUs are two examples of BLE and ZigBee combo chips. Though the CC2650 chip has less flash memory, it does not support both BLE and ZigBee stacks at the same time.

The low power solution can be designed using CC2650 or KW40Z wireless MCUs for the system to operate with low power by using BLE and ZigBee technologies. Low power end devices, mostly SMD packages can save power and the space.

V. CONCLUSION

The system that can blend the qualities of both Bluetooth and ZigBee can be designed which will take the IoT into another level where the communication between the user and devices and also the machine 2 machine communication can be achieved at the single platform. The devices can communicate via internet or maybe through Bluetooth if the internet is not available.

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