

Comparison of Different Communication Devices for Arduino Uno

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Abstract— There is a need to develop a system for monitoring agricultural environments for various factors like humidity, temperature, soil moisture, pH, ambient light etc. Respective data should be collected from remote place and to be sent to base station located at a far distance. This paper proposes a remote monitoring system using RF module. The nodes constitute various sensors connected to Arduino microcontroller with a RF module and the base station consists of Raspberry pi along with a RF module for remote monitoring of the nodes. It follows a Client server model where nodes behave as clients and base station as server. The sensor data will be sent wirelessly to the base station which collects, stores and analyses and result sent to the client mobile.

I. INTRODUCTION

Wireless communication medium is the transfer of data or information from two or more points that are not physically connected. The most common wireless communication use radio waves ex: Bluetooth. Some of the common wireless communication methods are Bluetooth, ZigBee, Wi-Fi module. Bluetooth is a wireless technology used to exchange data over a short distance. Bluetooth was invented by telecomm vendor Ericson in 1994. ZigBee is used in high level communication protocol used to create personal area network (PAN). ZigBee is a low power, low data rate, and close proximity ad hoc network. Wi-Fi Module follows TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network

II. DIFFERENT CONNECTING DEVICES

a) Bluetooth Module

Bluetooth module HC-05 is a MASTER/SLAVE module. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. It provides full duplex wireless communication. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC. This module can also be used to communicate between two microcontrollers like Arduino Uno. Or the microcontroller can communicate with Bluetooth enabled devices like phone or laptop. The module uses USART at 9600 baud rate for communication. Bluetooth network can be established in a point to point master-slave method, master and up to 7 slave piconet networks and scatter net.

b) ZigBee

It is mainly built to control the sensor networks and follows IEEE 802.15.4 standard for wireless area network (WPAN). It uses physical and media access control layer in order to handle many devices at low data rates. It is low cost and low powered with mesh network which can be deployed for controlling and monitoring the application. It covers a range of 10 – 100 meters. Zigbee system structure consists of three different types of devices such as ZigBee coordinator, router and end device. Coordinator is responsible for handling and storing the information. While performing receiving and data operations. Zigbee routers acts as intermediate devices that permit the data to pass to and fro from them to other devices. End devices have limited functionality to communicate to the parent nodes. ZigBee supports multiple network structures, which mainly include star, tree, and mesh network

c) Wi-Fi Module

ESP8266 is a self-contained SOC (system on chip). It has an integrated TCP/IP stack. It is also a 32-bit microcontroller. Using the TCP/IP protocol the microcontroller can access Wi-Fi network. ESP8266 is an extremely cost effective board and is powerful enough on board processing and storage capability. So that it can be integrated with the sensors and other application specific devices through its GPIO's.

III. COMPARISON CHART

Features	Bluetooth	Wi-Fi module	ZigBee	RF module
Range	10 meters	100 meters	10-100 meters	150 meters
Frequency range	2.400 GHz and 2.483 GHz	2.4 GHz and 5 GHz	2.4 GHz	30 kHz & 300 GHz
Flexibility	Supports limited number of user	It provides support for a large number of users	It can connect up to 65000 nodes	It supports large number of users.
Modulation technique	GFSK (Gaussian frequency shift keying)	OFDM (Orthogonal frequency division multiplexing) and QAM (Quadrature Amplitude Modulation)	Direct sequence spread spectrum (DSSS)	ASK, OOK, FSK, Direct-sequence spread spectrum. Frequency-hopping spread spectrum
Data Rate	1 Mbps (max upto 2 Mbps)	7 Mbps (max upto 13mbps)	250 Kbps	1Kbps - 10Kbps

d) RF-Module

RF module is an electronic device which is used to transmit or receive radio signals between two devices wirelessly. RF communication has two components transmitter and receiver. It can transmit up to a range of 500 feet. Frequency ranges from 30Khz to 300Ghz. Signals. Since RF signals can travel long distances it is suitable for long range application and also RF transmission is stronger than IR. And it is also reliable. Also RF communication uses specific frequency.

IV. CONCLUSION

From the above comparison we can conclude that Bluetooth can be used in case of small range data transmission with high data transfer rate and is usually fit to deploy in the places where module and the end devices are not farer than 10 metres. Wi-Fi module also acts same as Bluetooth but with higher data transfer range and broader range of 100m in outdoor and 10m when obstacle is present. ZigBee is typically used in low data rate applications that require long battery life and secure networking and is best suited for intermittent data transmissions from a sensor or input device. Communication over Radio Frequency has many advantages as it doesn't require a line of sight connection between the transmitter and receiver as in case of Infrared communication. The applications of RF modules mainly involve in low volume and medium volume products for consumer applications like wireless alarm systems, garage door openers, smart sensor applications, wireless home automation systems and industrial remote controls

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