

Wireless Control and transmission of Data for underwater Robot

D. S. Vidhya

Assistant Professor

*Department of Electronic & Telecommunication Engineering
Don Bosco College of Engineering*

Nehal Mapari

UG Student

*Department of Electronic & Telecommunication Engineering
Don Bosco College of Engineering*

Ansel Da Veiga

UG Student

*Department of Electronic & Telecommunication Engineering
Don Bosco College of Engineering*

Abstract

This paper describes how the wireless transmission takes place in the underwater robot for marine exploration. The robot collects the data from the sensors underwater and transmits it wirelessly to the remote station. The robot is based on the Arduino platform, which is used extensively as an experimental testbed and which is compatible with Xbee. The movement of the robot will also be controlled by wirelessly transmitting commands via Xbee. The components and construction is described and analysed.

Keywords: Xbee, Arduino testbed, Wireless transmission, serial terminal program, XCTU, PAN ID, MY address, destination address

I. INTRODUCTION

Today is the world of digitization, where the communication is become wireless and fast. So to match up with the world, we have developed a new method of wireless communication system for real time underwater robot. This new method may eliminate the need for long tether cables, offering a new degree of freedom in underwater robotics.

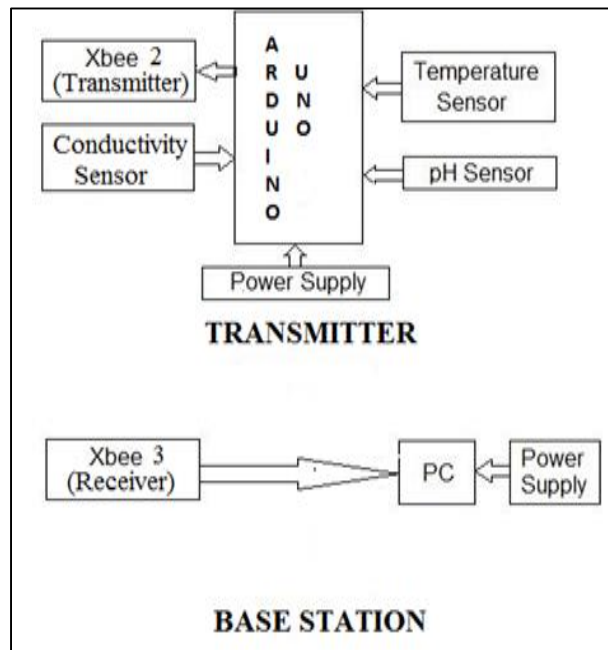
XBee communication is an enhanced wireless system is used for data transmission wirelessly. In this prototype, we introduce a new idea of wireless robot control system which is used as a tool to perform wireless control of the robot while it measures the parameters underwater. XBee is used for wireless transmission of the data. Arduino is used for interfacing sensors and motors. It is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. In recent trends the robots are working in vast applications, if our concept is adopted, it will enhance and increasing monitoring function done by the robot underwater wirelessly.

II. BLOCK DIAGRAM

A. Electronic Module:

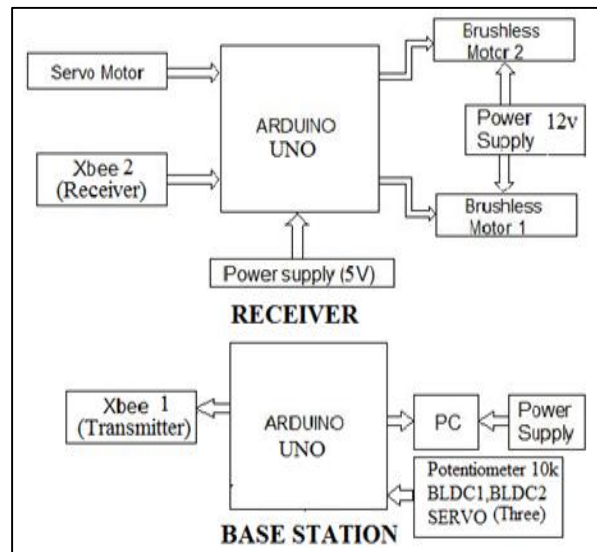
The electronic module show, the Xbee 2 acts as transmitter, which is interfaced with Arduino wirelessly transmits the data collected from the sensors.

At the base station the data is delivered to PC from another Xbee3 which acts as a receiver, via adapter



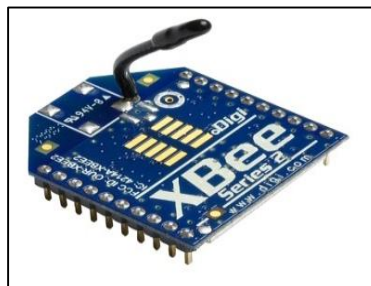
B. Navigation and Propulsion Module:

This module describes the control system of the underwater robot. The Xbee 1 which acts as a transmitter sends the pulse signals to the motors wirelessly to control the direction and speed of the motors. The brushless motors are for the forward and downward motion of the system and servo motor is for the direction control.



III. XBEE

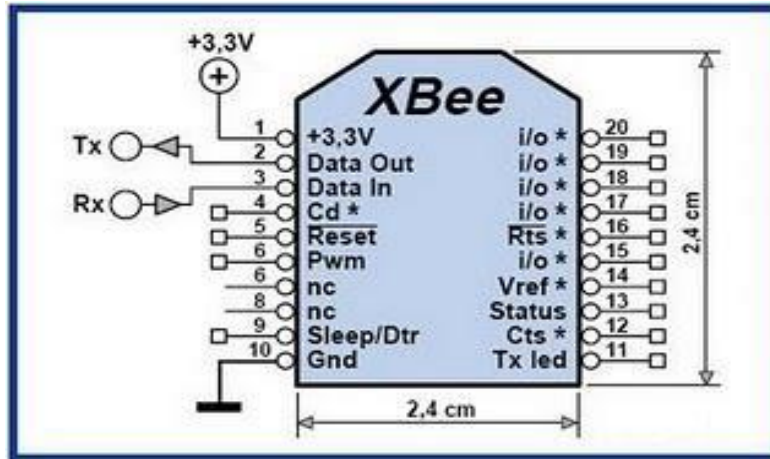
XBee is the brand name for Digi International for a family of Form factor compatible radio modules. XBee is a short range low data rate wireless communication system. It works on mesh networking. The speed is 250 Kbps but with noise it gives speed up to 25 Kbps. The IEEE standard for it is 802.15.4.



A. Specifications:

- 3.3V @ 40mA
- 250kbps Max data rate
- 2mW output (+3dBm)
- 400ft (120m) range (15m -20m in water)
- Built-in antenna
- 6 10-bit ADC input pins
- 8 digital IO pins
- 128-bit encryption
- AT or API command set

B. XBEE Pin Layout:



Pin #	Name	Direction	Description
1	VCC	-	Power supply
2	DOUT	Output	UART Data Out
3	DIN / CONFIG	Input	UART Data In
4	DO8*	Output	Digital Output 8
5	RESET	Input	Module Reset (reset pulse must be at least 200 ns)
6	PWM0 / RSSI	Output	PWM Output 0 / RX Signal Strength Indicator
7	PWM1	Output	PWM Output 1
8	[reserved]	-	Do not connect
9	DTR / SLEEP_RQ / DI8	Input	Pin Sleep Control Line or Digital Input 8
10	GND	-	Ground
11	AD4 / DIO4	Either	Analog Input 4 or Digital I/O 4
12	CTS / DIO7	Either	Clear-to-Send Flow Control or Digital I/O 7
13	ON / SLEEP	Output	Module Status Indicator
14	VREF	Input	Voltage Reference for A/D Inputs
15	Associate / AD5 / DIO5	Either	Associated Indicator, Analog Input 5 or Digital I/O 5
16	RTS / AD6 / DIO6	Either	Request-to-Send Flow Control, Analog Input 6 or Digital I/O 6
17	AD3 / DIO3	Either	Analog Input 3 or Digital I/O 3
18	AD2 / DIO2	Either	Analog Input 2 or Digital I/O 2
19	AD1 / DIO1	Either	Analog Input 1 or Digital I/O 1
20	AD0 / DIO0	Either	Analog Input 0 or Digital I/O 0

C. Working of XBEE:

For Xbee to transmit and receive data two Xbees are need one of which works as a transmitter and the other works as a receiver. Xbee can work either in AT mode or API mode. In AT mode is used when the network required isn't complex and only point to point connections are required. API mode is used for much complex networks where a central Xbee acts as a coordinator and the others act as end points.

D. Interfacing with ARDUINO:

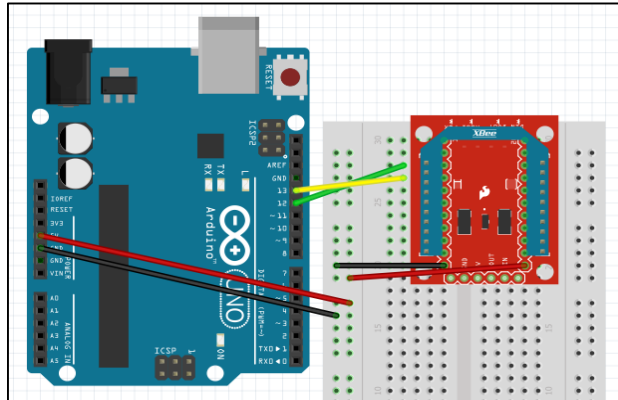
1) At transmitting end:

Tx of Arduino => Rx of Xbee.

Rx of Arduino =>Tx of Xbee.

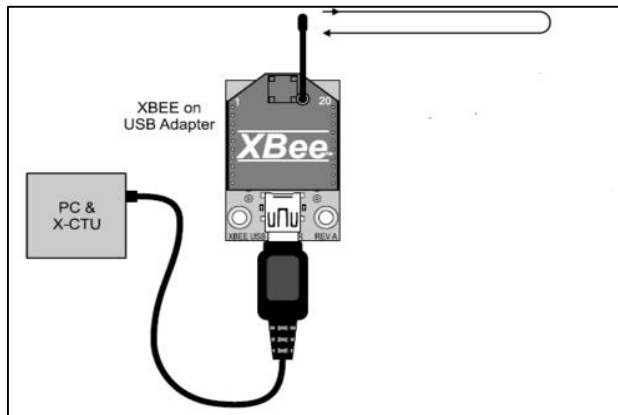
Gnd of Arduino => Gnd of Xbee.

Vcc of arduino => Vcc of Xbee.



2) At receiving end:

Xbee is connected to the PC using an interface that enables the use of a USB cable.



E. Setting up a Connection:

For communication to take place between 2 Xbees, one has to be configured as a router and the other as a coordinator. In order to configure the Xbees a serial terminal program is used. XCTU by Digi is a software used to configure Xbee.

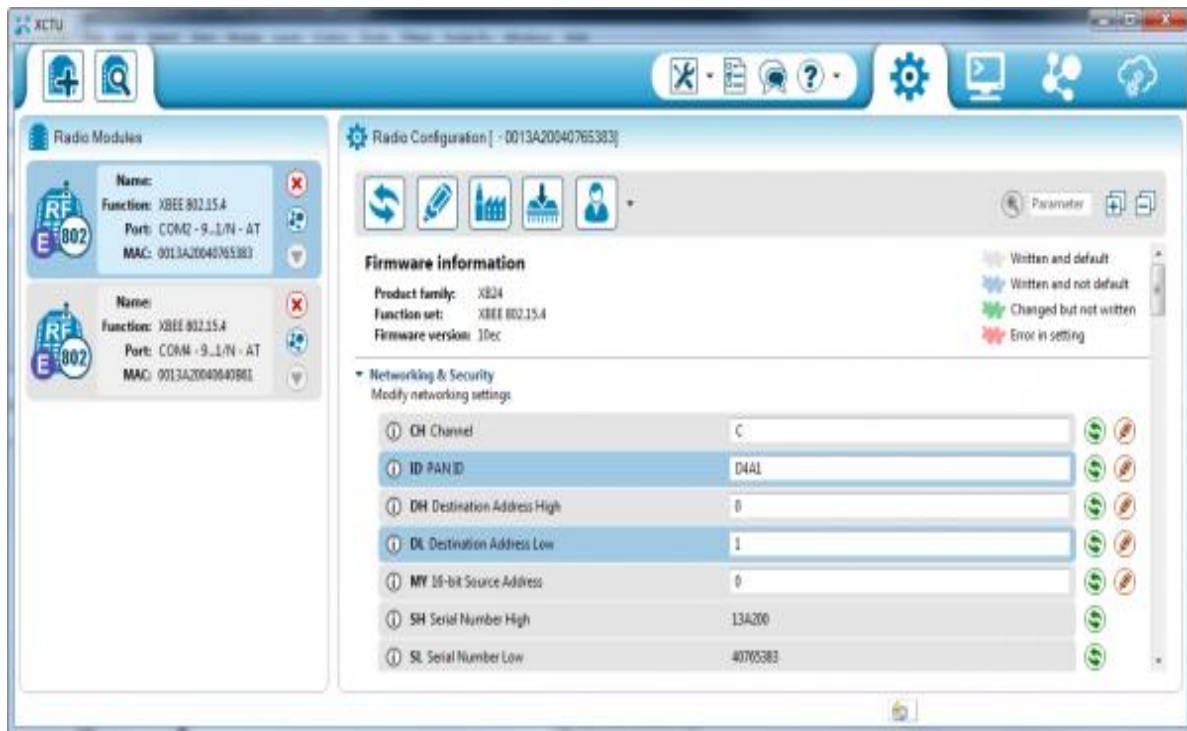
1) Adding XBEEs:

- To add your XBee, click the “Add device” icon.
- Select the COM port to which the Xbee is connected.
- Set baud rate as you wish. (Higher baud rate leads to faster serial communication).
- The other parameters are left as default.
- Click finish to add the module.

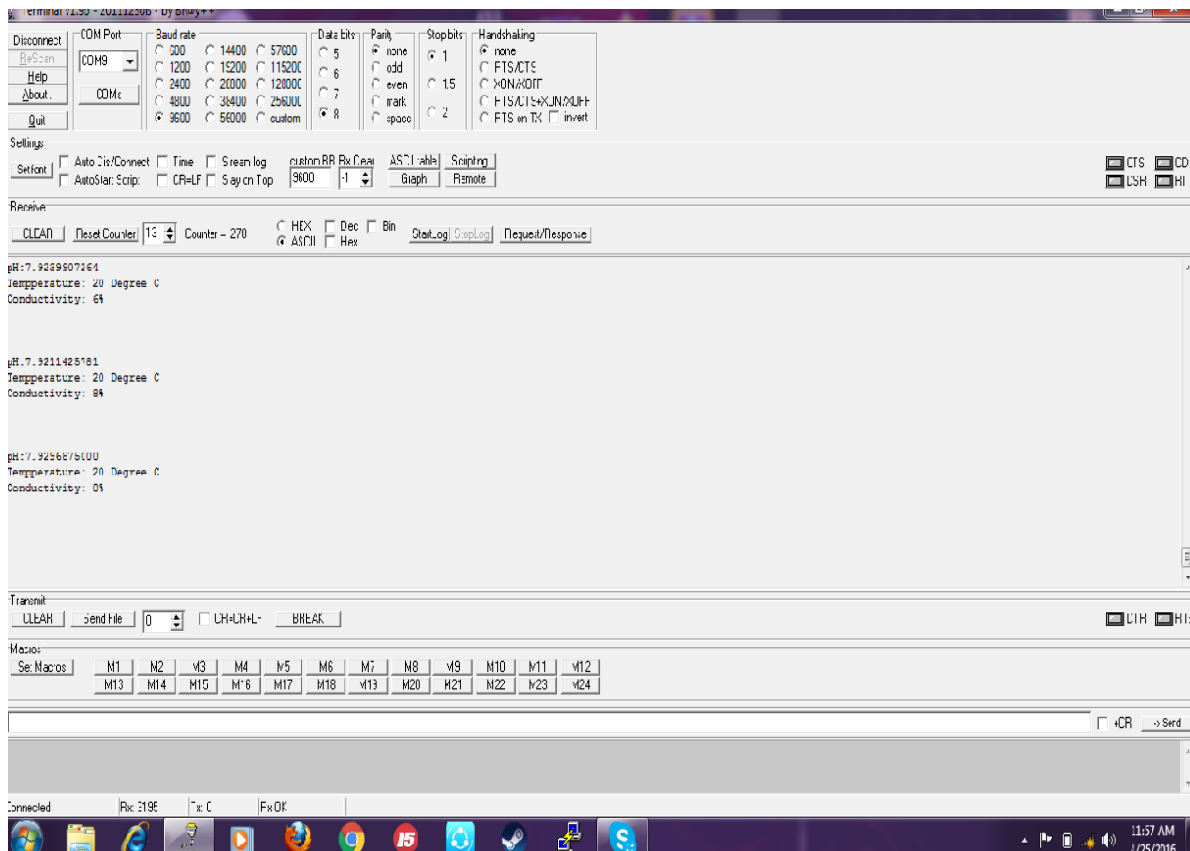
2) Configuring The Network:

For Xbees to communicate with each other, the three of the most important XBee settings PAN ID, MY address, and destination address have to be specified.

- 1) PAN ID: Personal area network ID. The network ID is a hexadecimal value between 0 and 0xFFFF. XBees can only communicate with each other if they have the same network ID
- 2) MY ADDRESS: Each XBee in a network should be assigned a 16-bit address which is referred to as MY address or the source address.
- 3) DESTINATION ADDRESS: The destination address, determines which source address an XBee can send data to. For one XBee to be able to send data to another, it must have the same destination address as the other XBee's source.



IV. RESULT



V. FUTURE SCOPE

The range of the ROV can be increased by increasing the wireless transmission range this can be achieved by changing the XBee module to XBee PRO or increasing the length of the antenna.

VI. CONCLUSION

As we know that underwater robotics is a new and upcoming field and also considerably expensive, we aim to make it cost effective with simple logics for easy access of any individual. The report specifies the fundamental study of a underwater prototype. The operation of Xbee and its programming was studied. Interfacing it with the Arduino was also studied and implemented successfully.

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