XBee(ZigBee) interfacing with AVR ATmega32

Overview of XBee

XBee (ZigBee) radios are based on **IEEE 802.15.4** (https://en.wikipedia.org/wiki/IEEE_802.15.4) (technical standard which defines the operation of low-rate wireless personal area networks (LR-WPANs)) standard and it is designed for point to point, star, etc. communication over the air.

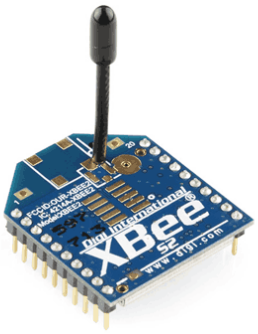
Zigbee is an IEEE 802.15.4-based specification for high-level communication protocols used to create **personal area networks** (https://en.wikipedia.org/wiki/Personal_area_network) with low-power digital radios.

Following are the major features of XBee radio devices,

- They work on 2.5GHz (Unlicensed Radio Band) radiofrequency.
- Low data rate (≈250Kbps).
- Low power consumption (1mW, 6mW, 250mW, etc.).
- Over short distance (90m, 750m, 1mile, etc.) wireless communication applications

Hence they are used in Home Automation, Wireless sensor n/w, Industrial control, Medical data collection, Building automation, etc.

To know more about how the Xbee module works, refer to **XBee Module** (https://www.electronicwings.com/sensors-modules/xbee-module)



XBee S2 Module

Let's interface the X-Bee module with ATmega32

Interfacing of XBee device with AVR ATmega32

Here, we have connected the following to the XBee End Device.

- 10K Potentiometer as analog sample
- Switch as a digital sample

Now we request those analog and digital samples from XBee End Device using XBee Coordinator.

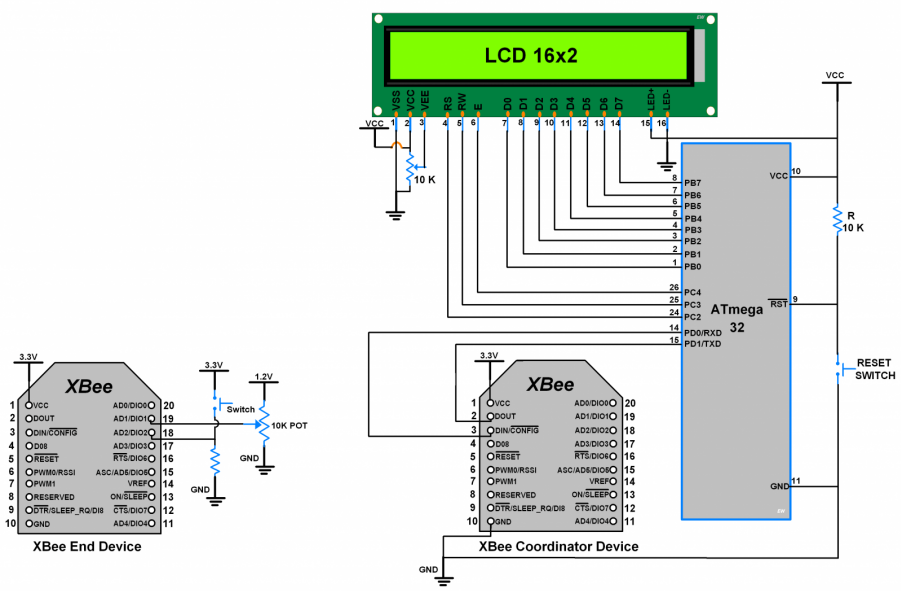
Now let's program ATmega32 to request Analog and Digital samples from the XBee end device through the XBee coordinator. Both XBee are used in API operating mode.

We are displaying the status of the switch in digital form (0 for OFF and 1 for ON), and the Analog voltage received by the XBee Coordinator Device on the 16x2 LCD connected to AVR based ATmega32.

Note that ADC Vref is varying according to XBee Model. Refer **ADC Voltages** (http://knowledge.digi.com/articles/Knowledge_Base_Article/Digital-and-analog-sampling-using-XBee-radios) to find Vref of your model.

The XBee model we are using is based on the ZigBee protocol and it has a fixed Vref of 1.2V.

Connection Diagram of XBee with ATmega16/32



Interfacing XBee With ATmega 32

> **Note:** In the above example, we need to configure XBee End Device pins (AD1/DIO1 & AD2/DIO2) as Analog and Digital input. Refer configuring the XBee pins section in **XBee Module** (https://www.electronicwings.com/sensors-modules/xbee-module).

Need to know

Here we are using XBee in API mode so for basic communication purpose we are building some basic frames like

- AT COMMAND FRAME: -
  - Using this frame, we can send AT command to the XBee device.
- REMOTE AT COMMAND FRAME: -
  - Using this frame, we can send AT command to the XBee device located at a remote location with their address specified in the frame.
- TRANSMIT REQUEST FRAME: -
  - Using this frame, we can transmit data string to the XBee device with their address specified in the frame.
- IO DATA SAMPLE FRAME: -

- Using this frame, we receive analog/digital data transmitted by the XBee device located at a remote location with their address specified in the frame.

In the below program, we are using functions that build the above-mentioned frames structure. API frame structure functions are lengthy, but easy to understand once we know each API Frame structure.

To be familiar with API frames and their structure refer to **API Frame Generator in the X-CTU** section in **XBee Module** (https://www.electronicwings.com/sensors-modules/xbee-module).

XBee Communication Code for ATmega16/32

```
/*
 * ATmega32 XBee
 * http://www.electronicwings.com
 */

#define F_CPU 8000000UL                 /* Define CPU clock Frequency 8MHz */
#include <avr/io.h>                     /* Include AVR std. library file */
#include <string.h>                     /* Include string library */
#include <stdio.h>                      /* Include standard I/O library */
#include <stdlib.h>                     /* Include standard library */
#include <util/delay.h>                 /* Include delay header file */
#include <avr/interrupt.h>          /* Include avr interrupt header file */
#include <stdbool.h>                /* Include boolean library */
#include "USART_RS232_H_file.h"         /* Include USART header file */
#include "LCD_16x2_H_file.h"

#define SREG    _SFR_IO8(0x3F)          /* Define Status Register */

/* Define Required XBee Frame Type and Responses */
#define START_DELIMITER                 0x7E
#define AT_COMMAND_FRAME                0x08
#define TRANSMIT_REQUEST_FRAME          0x10
```

Video of XBee Communication using ATmega16/32

Components Used

Powered By

ATmega 16 ATmega 16	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA16L-8PU?qs=%2Fha2pyFaduiGCJtTvs2wv8fVZbVAalLu7Iq%2FglTS0tALAx6fMenLvg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega-16/1/datasheet)
Atmega32 Atmega32	X 1	(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA32-16PU?qs=aqrrBurbvGdpkmgj7RWmsQ%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/atmega32/1/datasheet)

Components Used

XBee S2 Module XBee is a radio module developed by Digi Intern...	X 2	(https://www.mouser.in/ProductDetail/DIGI/XB3-24Z8PT-J?qs=%2Fha2pyFaduhSsfO4rIoaMEwI6Xrnnc75IwhRCq3AEFAcGF%252B%2FI4124w%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/xbee-s2-module/1/datasheet)
LCD16x2 Display LCD16x2 Display	X 1	(https://www.mouser.com/ProductDetail/Adafruit/1447?qs=XAKIUOoRPe6AClmsjw7y7g%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

Downloads

X-Bee Datasheet	Dow nloa d (/api/download/platform-attachment/216)

Downloads

ATmega XBee Project file

Dow nloa d (/api/download/platform-attachment/350)

Comments

Comment

pran0506
(/users/pran0506/profile)
2019-04-27 02:56:26

Sir , does the TRANSMIT REQUEST FRAME sense if the media is free to access? As i n does it check if the receiver is ready to receive data? I need to perform a multipoint to single point communication using xbee.

Reply Like

authorized
(/users/authorized/profile)
2019-04-27 16:56:02

I think its not. it just transmit rf data packet as is. but it has sense of whether transmitted data received by receiver or not. it has ability to automatically re transmit the same packet if acknowledgement not received by receiver.

multi-point to single point ? you mean star network where many transmitters (here xbee end devices or routers) transmit data to single receiver (here xbee coordinator). if yes then in that case there will be possibility of some packet drops at receiver end which increases with no of transmit devices. but auto re transmission feature will take care of that dropped packets by sending them again.

Reply Like 1

pran0506
(/users/pran0506/profile)
2019-04-28 01:25:15

Alright sir, Thank you so much. Of possible , can you link some page/website that may guide me properly for implementing the above mentioned Star Topology? Thanks :)

Reply Like

abhayvs610
(/users/abhayvs610/profile)
2019-10-22 14:55:15

If I use an XBee WiFi and use an Android app in a phone as the end device, would it be able to communicate directly or does it need a router inbetween?

Reply Like

JaydeenReid
(/users/JaydeenReid/profile)
2023-11-22 22:27:17

1. How do you get the first xbee to read the information off the pot? do u use a software to configure it to input pins?

2. How did u configure both to share information between each other?

Reply Like