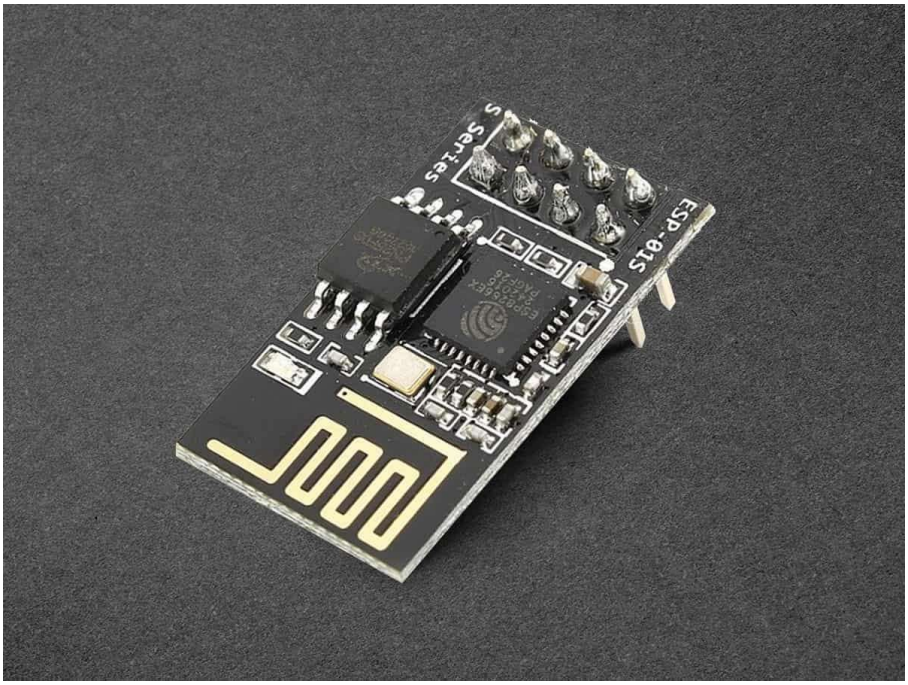
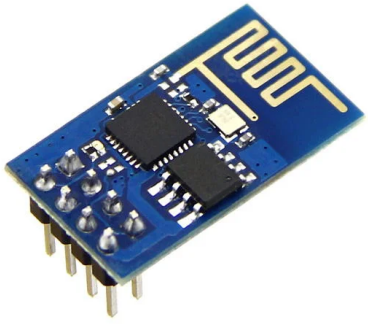
ESP8266 WiFi Module Interface with AVR ATmega16

Introduction



The ESP8266 wifi module is a low-cost standalone wireless transceiver that can be used for end-point IoT developments.

ESP8266 wifi module enables internet connectivity to embedded applications. It uses TCP/UDP communication protocol to connect with the server/client.



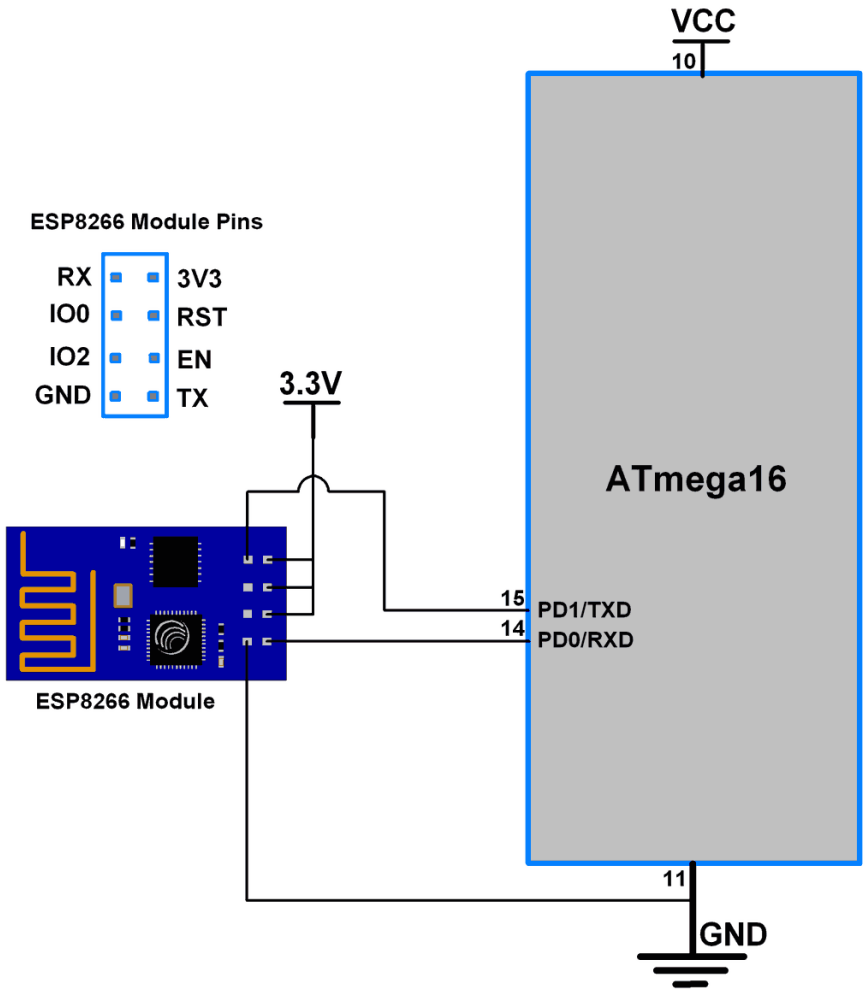
ESP8266-01 Wi-Fi Module

To communicate with the ESP8266 WiFi module, the microcontroller needs to use a set of AT commands. The microcontroller communicates with the ESP8266-01 WiFi module using UART having a specified Baud rate (Default 115200).

To know more about the ESP8266 WiFi Module and its firmware refer to ESP8266 Module (https://www.electronicwings.com/sensors-modules/esp8266-wifi-module)

Now let's interface the ESP8266 WiFi Module with AVR based ATmega16

Connection Diagram of ESP8266 With ATmega16



ATmega16 interface with ESP8266 Wi-Fi module

TCP Client using ESP8266 Wi-Fi Module

Let's program AVR ATmega16 to configure the ESP8266 wifi module as TCP Client and Receive/Send data from/to Server using WIFI.

Here, we are using the Thingspeak server for TCP Client demo purposes.

Thingspeak is an open IOT platform where anyone can visualize and analyze live data from their sensor devices. Also, we can perform data analysis on data posted by remote devices with Matlab code in Thingspeak. To learn more about Thingspeak refer link https://thingspeak.com/pages/learn_more (https://thingspeak.com/pages/learn_more)

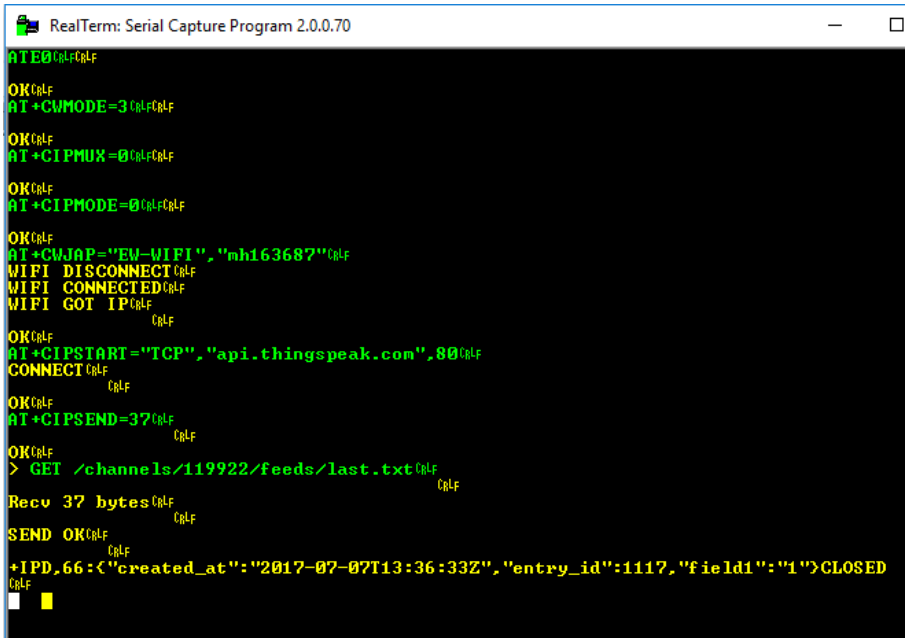
Just sign up and create a channel. We have below the channel and write key on Thingspeak for data send and receive.

- channel ID is = 119922
- Write Key is = C7JFHZY54GLCJY38

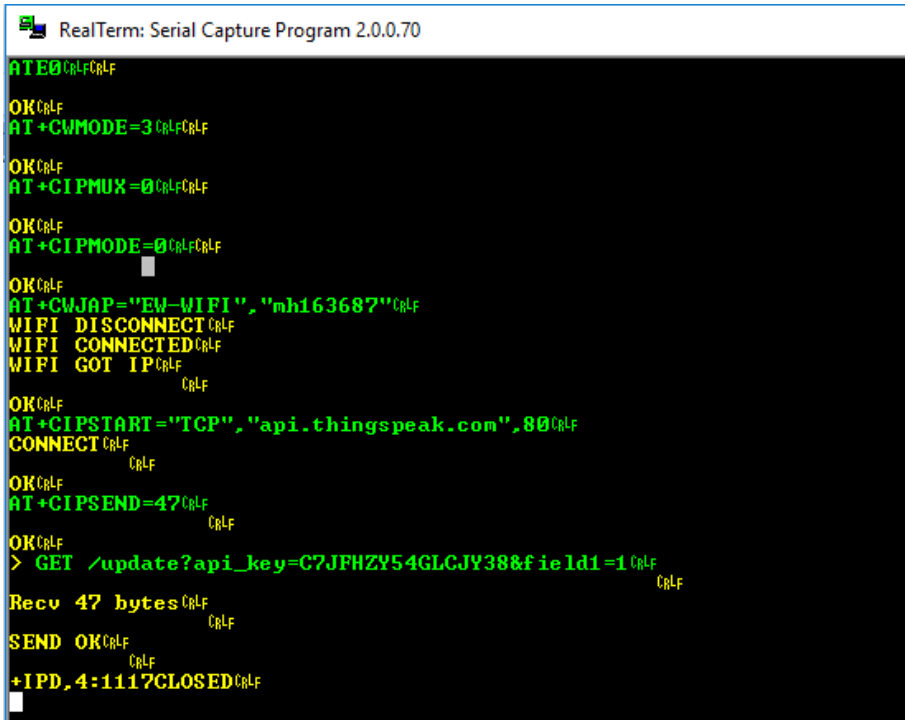
> Note: Do not forget to tick the **Make Public** field in the **channel setting** option on your thingspeak channel. It makes channels available to use as public. This allows any user to access channel data without any username & password.

For **TCP RECEIVE** method use below AT command steps shown in the screenshot of RealTerm Serial Terminal.

The below screenshot consists of AT commands (Green) and Responses (Yellow).



For the **TCP SEND** method use below AT command steps shown in the screenshot of RealTerm Serial Terminal.



In the below program of TCP Client, do the following

For TCP Client RECEIVE demo

```
#define RECEIVE_DEMO                /* Define Receive demo */
//#define SEND_DEMO                 /* Define Send demo */
```

For TCP Client SEND demo

```
//#define RECEIVE_DEMO              /* Define Receive demo */
#define SEND_DEMO                   /* Define Send demo */
```

Edit Fields below with respective data

```
/* Define Required fields shown below */
#define DOMAIN                      "api.thingspeak.com"
#define PORT                        "80"
#define API_WRITE_KEY               "thingspeak Write Key"
#define CHANNEL_ID                  "thingspeak Channel ID"

#define SSID                    "WiFi SSID"
#define PASSWORD                    "WiFi Password"
```

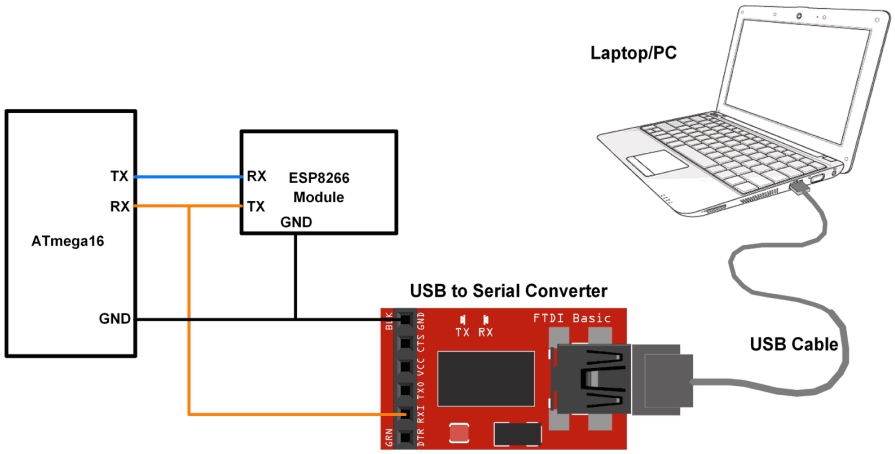
In the below program, we are using response-based functions to get the better status if things deviate from normal.

ESP8266 Code for ATmega16/32

```
/*
* ATmega16_WIFI
* http://www.electronicwings.com
*
*/

#define F_CPU 12000000UL            /* Define CPU Frequency e.g. here its Ext. 1
#include <avr/io.h>                 /* Include AVR std. library file */
#include <util/delay.h>             /* Include Delay header file */
#include <stdbool.h>            /* Include standard boolean library */
#include <string.h>                 /* Include string library */
#include <stdio.h>                  /* Include standard IO library */
#include <stdlib.h>                 /* Include standard library */
#include <avr/interrupt.h>      /* Include avr interrupt header file */
#include "USART_RS232_H_file.h"         /* Include USART header file */

#define SREG    _SFR_IO8(0x3F)

#define DEFAULT_BUFFER_SIZE         160
#define DEFAULT_TIMEOUT             10000

/* Connection Mode */
```

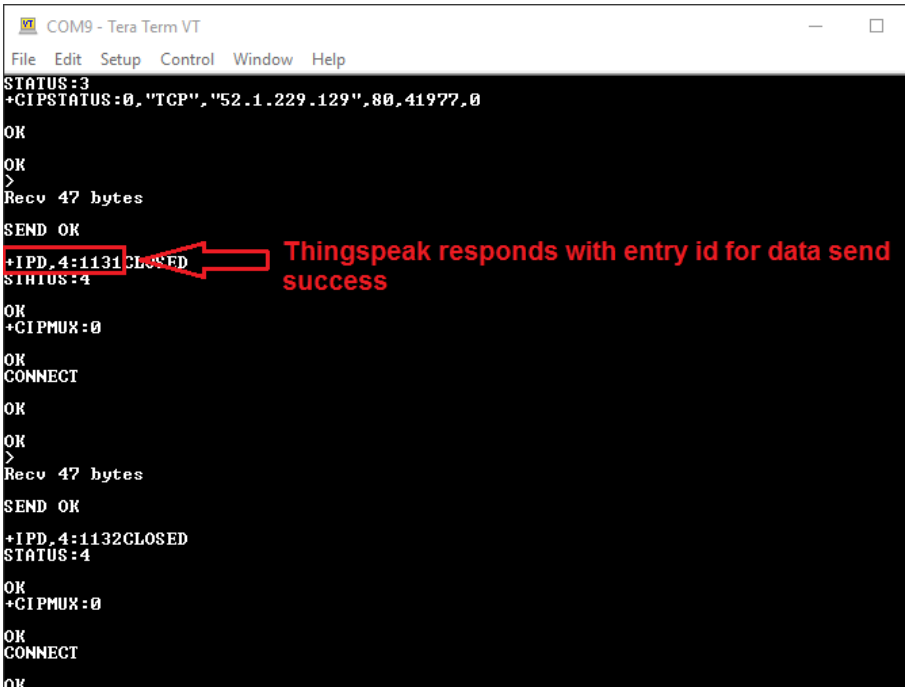
ESP8266 Response

At the client end, we need to check ESP8266 responses. We can check it on the serial terminal of the PC/Laptop. Connect the ESP8266 module transmit pin (TX) to the receive pin (RX) of Atmega16 Microcontroller and to the receive pin (RX) of USB to serial converter as shown in the below figure. connect USB to serial converter to PC/Laptop. Open the serial terminal on PC/Laptop to see the ESP8266 responses for the AT command sent from the Atmega16 microcontroller.



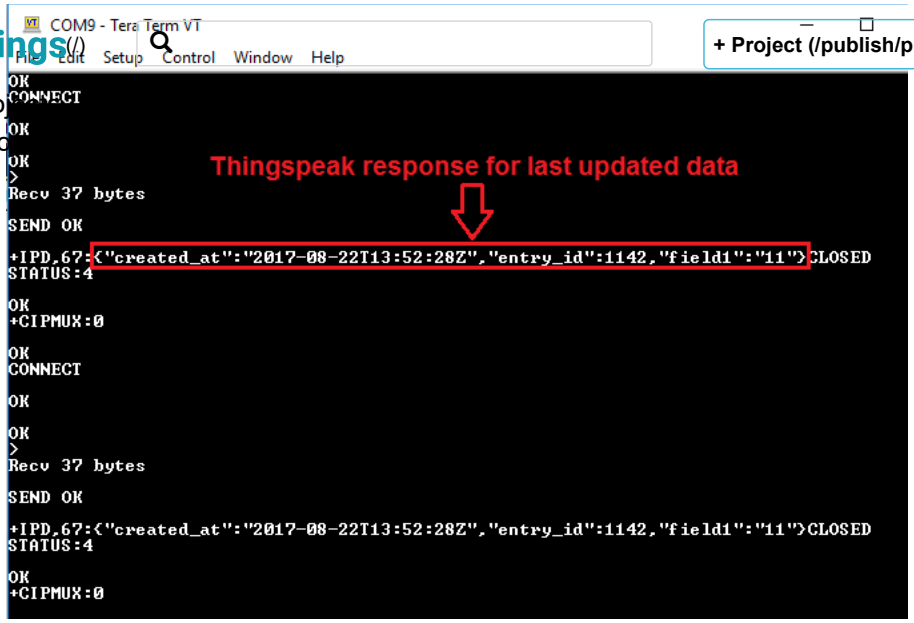
ATmega16 Interface with ESP8266 along with PC

Now for **TCP SEND** commands (sent from ATmega16 Microcontroller), we can see the below response from ESP8266 on the serial terminal for the Thingspeak server.



In response to **TCP SEND** we get the data entry no. as shown in the above figure i.e. 1131, 1132, and so on.

For **TCP RECEIVE** commands (sent from ATmega16 Microcontroller), we can see the below response from ESP8266 on the serial terminal for the Thingspeak server.

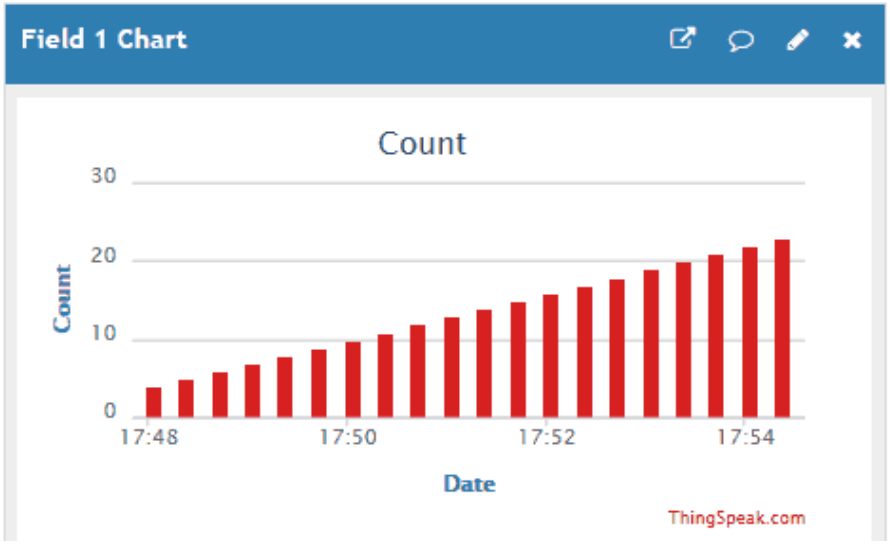


In response to **TCP RECEIVE** we get the last entry data for field1 on Thingspeak as shown in the above figure.

> **Note:** here we are retrieving the last entry data on field1 of the Thingspeak server hence we get the last updated data of field1 from the server as shown in the above figure i.e. “field1”:”11”. In the program, we used "GET /channels/119922/feeds/last.txt" to receive the last updated data only.

Updates at Thingspeak server on TCP SEND

For **TCP SEND** we can see the output at the server end. Here we are using the Thingspeak server and sending the incremented count at field1 on the server. We get incremented count at field1 of Thingspeak server as shown in the below figure.



MOUSER ELECTRONICS (https://www.mouser.in?utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

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)

Powered By MOUSER ELECTRONICS (https://www.mouser.in?utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

Components Used

ESP8266 WiFi Module ESP8266 is a system on chip (SoC) which provide...	X 1	(https://www.mouser.in/ProductDetail/Olimex-Ltd/MOD-WIFI-ESP8266?qs=%2Fha2pyFaduiM2FizGGE3eS5tzBwP6H7%2FU4oZoQX%252BUf3gTFtvjctAktEO9xN01fVd&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/esp8266-wifi-module/1/datasheet)
CP2103 USB TO UART BRIDGE CP2103 is single chip USB to UART Bridge. It su...	X 1	(https://www.mouser.com/ProductDetail/Silicon-Labs/CP2103-GMR?qs=Zq62GxwlckYrXEgTuxpNRg%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0) Datasheet (/components/cp2103-usb-to-uart-bridge/1/datasheet)

Downloads

ESP8266 Datasheet	Dow (/api/download/platf nloa orm-attachment/531) d
ESP8266 AT Commands	Dow (/api/download/platf nloa orm-attachment/532) d
ESP8266 Getting Started Guide	Dow (/api/download/platf nloa orm-attachment/533) d
ATmega16 ESP8266 WiFi project files	Dow (/api/download/platf nloa orm-attachment/534) d

Comments

Comment

staringnet
(/users/staringnet/profile)
2017-10-25 00:56:54

I've tried all you have said but unfortunately nothing happens.
Not even AT shown on Serial monitor of Arduino IDE.
Please tell me what to do.
I've already included your header and C file but no response.
Kindly reply as soon as possible.
thanks
Reply Like

lokeshc
(/users/lokeshc/profile)
2017-10-25 23:57:34 • Edited

@Manish Verma: hello Manish,

I am not sure about what is exactly happening in your application. the above example is working as per the document.

first, make sure about firmware you are using for module. refer http://www.electronicwings.com/sensors-modules/esp8266-wifi-module To know about how to download AT firmware on esp8266 module.

then you need to check the esp8266 module response by sending AT commands through the serial monitor.

if the response is getting properly then you can use above example to check

whether it is working or not.
hope it will work for you.
Reply Like

anandusree07
(/users/anandusree07/profile)
2018-03-12 02:32:00

Sir,
I too have the same issue.
When iam working the esp 8266 with usart commands it runs and the value is being sent to thingspeak.But when Im using this code and the serial monitor we can see like the below
PªÅPªQüPªÅPªQüPªÅPªQüPªÅPªQüP..etc.
baud rate=115200.
I have changed all the values which u said earlier.
Reply Like

lokeshc
(/users/lokeshc/profile)
2018-03-12 20:07:07

Have you set the baud rate of serial terminal to 115200?
It seems that the code is working in your case as you are getting value at thingspeak.
But in serial terminal case, there may be a baud rate mismatch so output you are getting is gibberish.
Reply Like

KingOfTheGeeks
(/users/KingOfTheGeeks/profile)
2018-08-09 09:39:12

I had to make some changes to the registers for a 328P but this does work and very well for me. Thank you sir !
Reply Like 1

andrith187
(/users/andrith187/profile)
2019-09-08 19:08:29

Could you share some more info on that?
Reply Like

rubberduckie
(/users/rubberduckie/profile)
2018-10-02 05:16:25

Hi. I am using the ESP8266 and Atmega32 without the serial communication. For some reason, I cannot get the ESP to start or initialize. Any ideas or suggestions?
Reply Like

dariociada
(/users/dariociada/profile)
2018-10-18 11:04:50

The program works fine. Thank you! However, there is some garbage (Bad characters) summoned after transmission. For example, if i transmit the voltage value "220.00" inside the while (1), I get the following sequence

220.00
220.00
220.00
220.00¨Ç
220.00
220.00

Etc.

Do you see the same behaviour?

Thank you!

Dario

Reply Like

sharmaguru25

(/users/sharmaguru25/profile)
2019-03-10 08:42:45

Hello sir, can you please tell me how can i retrieve only the value from all received string. I want to perfrom some action with that vue but I'm unable to extract that value after field 1. Please help

Reply Like

Sunnylallsamiksha

(/users/Sunnylallsamiksha/profile)
2019-08-10 03:13:51

Hi, can a similar approach be used to interface an ATMEGA32 with a WISOL SFM10R1 module?
Thanks.

Reply Like

HasithaKumarasinghe

(/users/HasithaKumarasinghe/profile)
2021-04-05 23:18:50

This is awesome. Works for atmega 328p also but had to chnage the registers and the ISR vector.

Reply Like 1

jorgeelectronica10

(/users/jorgeelectronica10/profile)
2022-05-09 22:18:31

Hi, I'm trying to use it also with the ATMega328p, but I can't make it even connect to my Wi-Fi network. Colud you please send me your code? I already changed the registers, the frequency (1 MHz, internal oscillator) and the baud rate to 9600.

Reply Like

EliaPupeschi

(/users/EliaPupeschi/profile)
2021-05-10 16:00:57

Hi, very useful tutorial. Only a question, about "Send section":

```
#ifdef SEND_DEMO
memset(_buffer, 0, 150);
sprintf(_buffer, "GET /update?api_key=%s&field1=%d", API_WRITE_KEY,
Sample++);
ESP8266_Send(_buffer);
_delay_ms(15000); /* Thingspeak server delay */
#endif
```

In this part, where you put the data to send?

Thanks in advance,
Elia

Reply Like

MateuszPorbski

(/users/MateuszPorbski/profile)
2022-01-22 04:12:43

If anyone is having trouble with sending data while using the internal oscillator of AVR (Atmega32 in my case, 1MHz), try changing the ESP's baudrate to 9600 with AT+UART_DEF command. The syntax is: AT+UART_DEF=<baudrate>, <databits>, <stopbits>, <parity>, <flow control>, I used AT+UART_DEF=9600,8,1,0,0.
Also remember to change the baudrate in main.c and your serial monitoring apps.
Otherwise, the code works perfectly.

Reply Like

NishantJ
(/users/NishantJ/profile)
2022-03-23 15:51:40

Aren't you damaging esp pins by 5v?

Reply Like