How to connect, communicate and download

from FTP server with AT commands using ESP01

"*This text is aimed for beginners as me, who may scratch their head with their trials with FTP.*"

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Some theory background

FTP is an universal way of file transfer for various computer platforms. It communicates on two ports. Port 21 is command port, while port 20 is data port, details will be discussed below. ESP01 does not support some higher AT commands for work with FTP. FTP connection from ESP01 has to be realised by TCP layer AT commands instead.

Opening FTP connection

ESP01 will be the client. Let's assume you already have established WiFi connection. First you need to enable multiple connection: `AT+CIPMUX=1`
This will enable more paralel connection which is necessary if you want to transfer files or print a directory list.

Now let's open FTP connection
`AT+CIPSTART=0,"TCP","...here comes ftp server name...",21`
The 0 means ID link number. And you shoul dalways use it. You should receive a welcome message from a server.

Sending commands to FTP server

Now you need to login to the server wih USER and PASS commands:
`AT+CIPSEND=0,x`
;where 0= ID link number, and x= length of command including CR and LF at the end. It has to match exactly the length of your command. If it is shorter your command will not be sent complete. If it is longer, than ESP01 will wait until it receives the lenght in x.

Now a ">" appears so you now type command "USER"+ your user name. Then type in command "PASS"+ your password. You now should be sucessfuly logged in. Now, you may try to enter a command "HELP" that will display a list of available commands of the server. So just enter:

```
AT+CIPSEND=0,6
> HELP
```

This way, you may for example create a new dir, rename a file or find out file length. So respectively type in:

```
AT+CIPSEND=0,x
> MKD ...your name...AT+CIPSEND=0,x
> RNFR ..old file name...
AT+CIPSEND=0,x
> RNTO .. new file name...
AT+CIPSEND=0,x
> SIZE ...your file...
```

Data exchange between ESP01 and FTP server

However, now something more useful. Directory list and file retrieve. Both will not work on ESP01 with just one connection. You will need two connections. So CIPMUX has to be in 1.

The principle is like this. The FTP protocol requires 2 TCP connections, one for the commands which we have already described above and the second for the data which we are going to venture in now. The first is on the port 21 but the second is not on port 20 but on a number that is defined by the FTP server dynamically during the connection. The port 20 is valid only when using the FTP in active mode but this requires an TCP server on the client side so it is not frequently used.

In general, in passive mode (command "PASV"), the server determines automatically the port to be used for the data connection and sends this information as below:

This happens when sending the command "PASV"

```
227 Entering Passive Mode (h1,h2,h3,h4,p1,p2)
```

Where h1, h2, h3 and h4 represents the 4 bytes of the IP address and the port = p1 * 256 + p2

A new TCP connection has to be opened to the IP address of the server on the port p1*256 + p2 using this connection data can be exchanged. Important, after data will be successfully sent from the server to the client, the server will close the connection automatically. So for every data transfer new connection has to be always established.

And now in practise. So, multiple connections with AT+CIPMUX=1 has been enabled and you are successfully logged in to the FTP server.

```
AT+CIPSEND=0,6
> PASV
```

You receive a message:

```
227 Entering Passive Mode (h1,h2,h3,h4,p1,p2)
```

Now you need to connect to that port with ESP01 with:

`AT+CIPSTART=1,"TCP","h1,h2,h3,h4",port`

;h1-h4 is a IP address most probably the same as you already used. Port is a (p1*256)+p2 number given out by command PASV. So now you have two connections running in parallel. One is ID=0 on 21 a command port, and the other is ID=1 on a data port. The server and ESP01 client are now ready to exchange data. So for directory list and file download type this respectively:

`AT+CIPSEND=0,6`

`> LIST` ; a directory list should now be poured out to the screen or memory

; connection with ID=1 will be closed automatically by the server

`AT+CIPSEND=0,x`

`> RETR ...file name...` ; a file should now be poured out to the screen or memory

; connection with ID=1 will be closed automatically by the server

Just take a notice, that we are sending these commands to command port (ID=0).

That's the miracle. Quite easy. But I was scratching my head over it for several days, so hopefully you will find it useful. Thanks to ***Shrek*** and ***Cicciocb***. Big thanks to ***Tim Gilberts***, the author of UART22E terminal, which I used for FTP (and other) experiments. It enables CIPSEND mode so you do not have to bother with AT+CIPSEND command all the time. Just switch to CIPSEND mode with INV VIDEO.

Wifi BIOS

Currently most Wi-Fi applications use WiFi BIOS 1.9 (latest version). This BIOS works like any other bios, it is a low level software layer (with low level routines) that enables communication between HW and application. The bios serves for ESP module that sits in MB03+ and in eLeMeNt ZX. But if some has a different WiFi model, they can just write a new bios for it and all higher application, including those existing, should work with the new bios without need of application changes. You may also use the bios in your applications.

More details on webpage https://hood.speccy.cz/dwnld/wifi_bios_info.htm