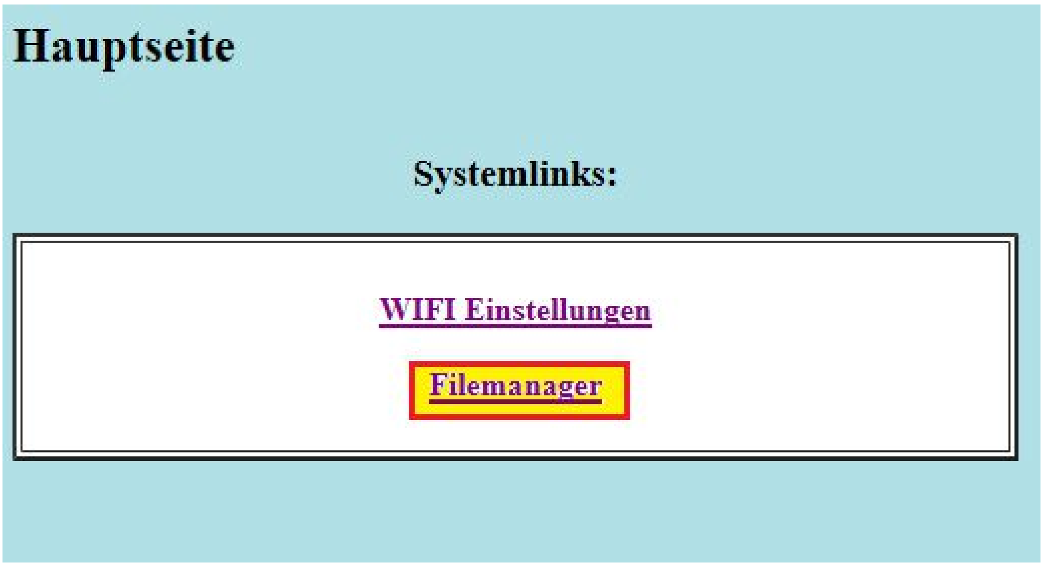
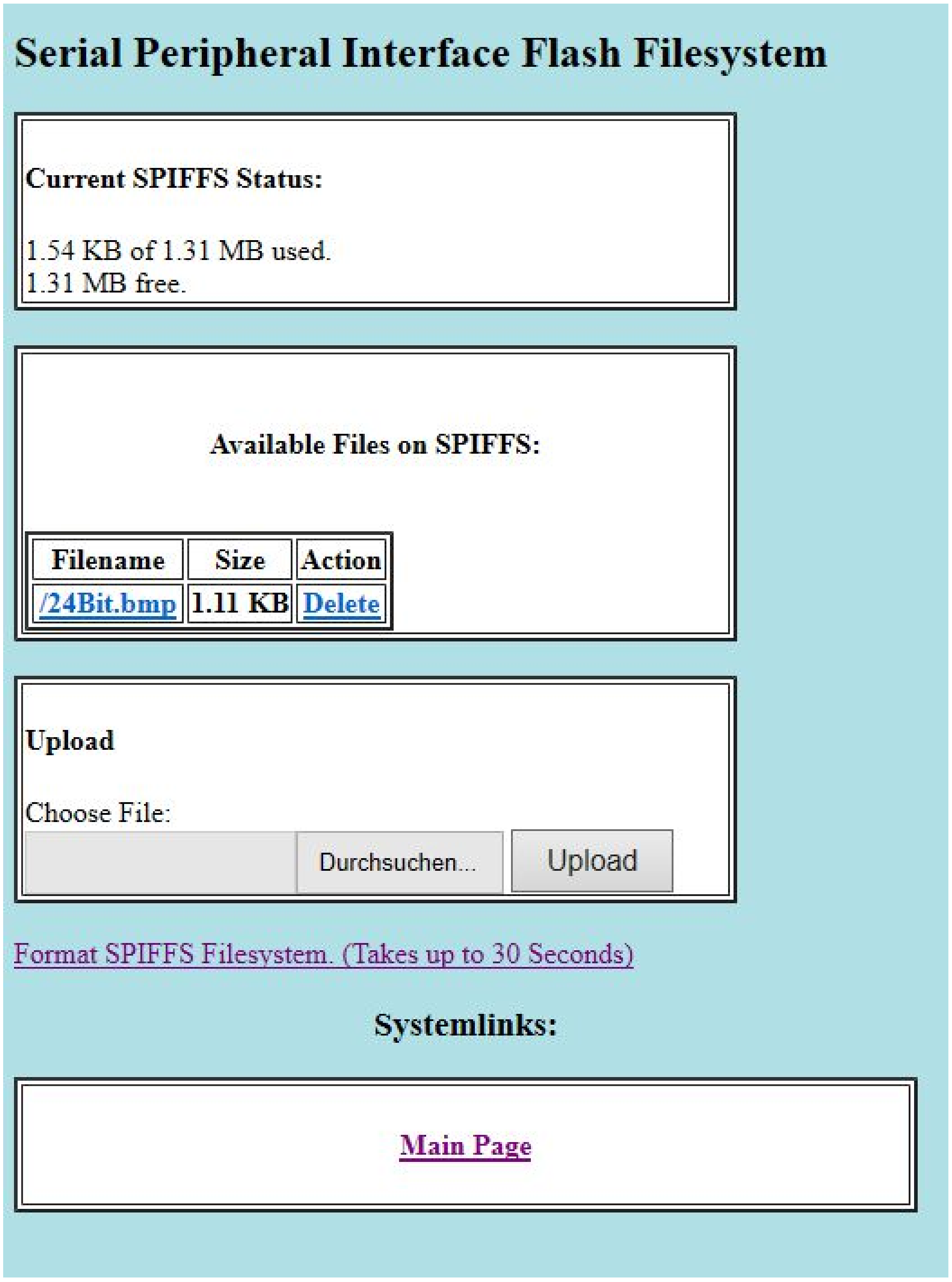
Ein SPIFFS Fileserver mit dem ESP 32

Hallo und wilkommen zu einem neuen Teil der ESP Captive portal Reihe. Im heuttigen Blog erweitern wir unser Captive Portal um eine erste Anwendung: Als File Server ! Über das Web Portal können Dateien bis maximal interne SPIFFS Größe hochgeladen, aber auch wieder heruntergeladen werden. Um diese Funktion bequem zu steuern, bauen wir unser Hauptmenü um einen weitern (Unter)punkt aus: Wir fügen den Punkt „Filemanger“ als Link in die Systemlinks ein, und bauen uns eine Unterseite mit den wichtigsten Dateifunktionen, die so ein Dateiserver benötigt Die Hauptseite unseres Dateiservers sieht dann wie folgt aus:



Wir sehen den hier neu hinzugekommen Punkt „Filemanager“. Unter diesem Punkt bauen wir nun eine neue Webseite auf, die alle wichtigen Punkte für ein Dateimanagement enthält:


Serial Peripheral Interface Flash Filesystem

Current SPIFFS Status:

1.54 KB of 1.31 MB used.
1.31 MB free.

Available Files on SPIFFS:

Filename	Size	Action
/24Bit.bmp	1.11 KB	Delete

Upload

Choose File:

Format SPIFFS Filesystem. (Takes up to 30 Seconds)

Systemlinks:

Main Page

Bevor wir nun das SPIFFS Dateisystem über unseren webserver zur Ablage unserer ersten Datei nutzen können, sollten wir es formatieren. Dazu gibt es den Link „Format SPIFFS Filesystem“, der nachdem er angeklickt wurde, das SPIFFS Dateisystem für die erste Verwendung formatiert. Wir klicken also zuerst darauf, und warten ab, bis das Dateisystem intern formatiert wurde. Danach kann die erste Datei abgelegt werden. Für die Ablage/Neuanlage von Dateien nutzen wir die darüber angelegten Buttons.

Dies wäre zum einen ein Button, mit dem eine Datei des lokalen Festplattenspeichers“ ausgesucht werden kann und weiterhin ein Button, mit dem diese ausgewählte Datei anschließend auf unseren ESP hochgelanden werden kann.

Diese Datei erscheint anschließend, nach einem automatischen neuen Laden der Seite im oberen Teil unter „Avaliable Files on SPIFFS“. Dort kann sie zum einen wieder heruntergeladen werden, aber auch, falls sie nicht mehr benötigt wird, wieder gelöscht werden. Mehr ist für ein Dateiablagesystem auch gar nicht mehr notwendig. Der Speicher ist ausreichend für mehrerer kleine Dateien oder Bilder.

Der um die Fileserver Funktioalität ergänzte Code für das Captive Portal für den ESP32 lautet:

```
#include <WiFi.h>
#include <WiFiClient.h>
#include <WebServer.h>
#include <ESPmDNS.h>
#include <SPIFFS.h>
#include <DNSServer.h>
#include <EEPROM.h>

#define GPIO_OUT_W1TS_REG (DR_REG_GPIO_BASE + 0x0008)
#define GPIO_OUT_W1TC_REG (DR_REG_GPIO_BASE + 0x000c)

static const byte WiFiPwdLen = 25;
static const byte APSTANameLen = 20;

struct WiFiEEPromData
  {
    bool APSTA = true; // Access Point or Sation Mode - true AP Mode
    bool PwDReq = false; // PasswordRequired
    bool CapPortal = true ; //CaptivePortal on in AP Mode
    char APSTAName[APSTANameLen]; // STATION /AP Point Name TO cONNECT, if definded
    char WiFiPwd[WiFiPwdLen]; // WiFiPAssword, if definded
    char ConfigValid[3]; //If Config is Vaild, Tag "TK" is required"
  };

/* hostname for mDNS. Should work at least on windows. Try http://esp8266.local */
const char *ESPHostname = "ESP32";

// DNS server
const byte DNS_PORT = 53;
DNSServer dnsServer;

//Conmmon Paramenters
bool SoftAccOK  = false;

// Web server
WebServer server(80);

/* Soft AP network parameters */
IPAddress apIP(172, 20, 0, 1);
IPAddress netMsk(255, 255, 255, 0);
```

```
unsigned long currentMillis = 0;
unsigned long startMillis;

/** Current WLAN status */
short status = WL_IDLE_STATUS;

File fsUploadFile;              // a File object to temporarily store the received file
WiFiEEPromData MyWiFiConfig;
String getContentType(String filename); // convert the file extension to the MIME type
bool handleFileRead(String path);       // send the right file to the client (if it exists)
void handleFileUpload();                // upload a new file to the SPIFFS
String temp ="";


void setup()
{
  REG_WRITE(GPIO_OUT_W1TS_REG, BIT(GPIO_NUM_16));     // Guru Meditation Error
Remediation set
  delay(1);
  REG_WRITE(GPIO_OUT_W1TC_REG, BIT(GPIO_NUM_16));     // Guru Meditation Error
Remediation clear
  bool ConnectSuccess = false;
  bool CreateSoftAPSucc  = false;
  bool CInitFSSystem  = false;
  bool CInitHTTPServer  = false;
  byte len;
  Serial.begin(9600);
   while (!Serial) {
    ; // wait for serial port to connect. Needed for native USB
  }
  Serial.println(F("Serial Interface initalized at 9600 Baud."));
  WiFi.setAutoReconnect (false);
  WiFi.persistent(false);
  WiFi.disconnect();
  WiFi.setHostname(ESPHostname); // Set the DHCP hostname assigned to ESP station.
  if (loadCredentials()) // Load WLAN credentials for WiFi Settings
  {
     Serial.println(F("Valid Credentials found."));
     if (MyWiFiConfig.APSTA == true)  // AP Mode
      {
        Serial.println(F("Access Point Mode selected."));
        len = strlen(MyWiFiConfig.APSTAName);
        MyWiFiConfig.APSTAName[len+1] = '\0';
        len = strlen(MyWiFiConfig.WiFiPwd);
        MyWiFiConfig.WiFiPwd[len+1] = '\0';
        CreateSoftAPSucc = CreateWifiSoftAP();
      } else
      {
        Serial.println(F("Station Mode selected."));
        len = strlen(MyWiFiConfig.APSTAName);
        MyWiFiConfig.APSTAName[len+1] = '\0';
        len = strlen(MyWiFiConfig.WiFiPwd);
```

```
       MyWiFiConfig.WiFiPwd[len+1] = '\0';
       len = ConnectWifiAP();
       if ( len == 3 ) { ConnectSuccess = true; } else { ConnectSuccess = false; }
     }
  } else
  { //Set default Config - Create AP
    Serial.println(F("NO Valid Credentials found."));
    SetDefaultWiFiConfig ();
    CreateSoftAPSucc = CreateWifiSoftAP();
    saveCredentials();
    delay(500);
  }
  // Initalize Filesystem
  CInitFSSystem = InitalizeFileSystem();
  if (!(CInitFSSystem)) {Serial.println(F("File System not initalized ! ")); }
  if ((ConnectSuccess or CreateSoftAPSucc))
    {
     Serial.print (F("IP Address: "));
     if (CreateSoftAPSucc) { Serial.println(WiFi.softAPIP());}
     if (ConnectSuccess) { Serial.println(WiFi.localIP());}
     InitalizeHTTPServer();
    }
    else
    {
     Serial.setDebugOutput(true); //Debug Output for WLAN on Serial Interface.
     Serial.println(F("Error: Cannot connect to WLAN. Set DEFAULT Configuration."));
     SetDefaultWiFiConfig();
     CreateSoftAPSucc = CreateWifiSoftAP();
     InitalizeHTTPServer();
     SetDefaultWiFiConfig();
     saveCredentials();
    }
}

void InitalizeHTTPServer()
 {
  bool initok = false;
  /* Setup web pages: root, wifi config pages, SO captive portal detectors and not found. */
  server.on("/", handleRoot);
  server.on("/wifi", handleWifi);
  server.on("/filesystem", HTTP_GET,handleDisplayFS);
  server.on("/upload", HTTP_POST, []() {
  server.send(200, "text/plain", "");
  }, handleFileUpload);
  //if (MyWiFiConfig.CapPortal) { server.on("/generate_204", handleRoot); } //Android captive
portal. Maybe not needed. Might be handled by notFound handler.
  // if (MyWiFiConfig.CapPortal) { server.on("/favicon.ico", handleRoot); }   //Another Android
captive portal. Maybe not needed. Might be handled by notFound handler. Checked on Sony
Handy
  // if (MyWiFiConfig.CapPortal) { server.on("/fwlink", handleRoot); }  //Microsoft captive portal.
Maybe not needed. Might be handled by notFound handler.
  server.on("/generate_204", handleRoot);  //Android captive portal. Maybe not needed. Might be
handled by notFound handler.
```

```
  server.on("/favicon.ico", handleRoot);    //Another Android captive portal. Maybe not needed.
Might be handled by notFound handler. Checked on Sony Handy
  server.on("/fwlink", handleRoot);   //Microsoft captive portal. Maybe not needed. Might be
handled by notFound handler.
  server.onNotFound ( handleNotFound );
  // Speicherung Header-Elemente anfordern
  // server.collectHeaders(Headers, sizeof(Headers)/ sizeof(Headers[0]));
  server.begin(); // Web server start
 }

boolean InitalizeFileSystem() {
  bool initok = false;
  initok = SPIFFS.begin();
  delay(200);
  if (!(initok))
  {
    Serial.println(F("Format SPIFFS"));
    SPIFFS.format();
    initok = SPIFFS.begin();
  }
  return initok;
}

boolean CreateWifiSoftAP()
{
  WiFi.disconnect();
  Serial.print(F("Initalize SoftAP "));
  if (MyWiFiConfig.PwDReq)
    {
      SoftAccOK  =  WiFi.softAP(MyWiFiConfig.APSTAName, MyWiFiConfig.WiFiPwd); //
Passwortlänge mindestens 8 Zeichen !
    } else
    {
      SoftAccOK  =  WiFi.softAP(MyWiFiConfig.APSTAName); // Access Point WITHOUT Password
      // Overload Function:; WiFi.softAP(ssid, password, channel, hidden)
    }
  delay(2000); // Without delay I've seen the IP address blank
  WiFi.softAPConfig(apIP, apIP, netMsk);
  if (SoftAccOK)
  {
  /* Setup the DNS server redirecting all the domains to the apIP */
  dnsServer.setErrorReplyCode(DNSReplyCode::NoError);
  dnsServer.start(DNS_PORT, "*", apIP);
  Serial.println(F("successful."));
  // Serial.setDebugOutput(true); // Debug Output for WLAN on Serial Interface.
  } else
  {
  Serial.println(F("Soft AP Error."));
  Serial.println(MyWiFiConfig.APSTAName);
  Serial.println(MyWiFiConfig.WiFiPwd);
  }
  return SoftAccOK;
}
```

```
byte ConnectWifiAP()
{
  Serial.println(F("Initalizing Wifi Client."));
  byte connRes = 0;
  byte i = 0;
  WiFi.disconnect();
  WiFi.softAPdisconnect(true); // Function will set currently configured SSID and password of the
soft-AP to null values. The parameter  is optional. If set to true it will switch the soft-AP mode off.
  delay(500);
  WiFi.begin(MyWiFiConfig.APSTAName, MyWiFiConfig.WiFiPwd);
  connRes  = WiFi.waitForConnectResult();
  while (( connRes == 0 ) and (i != 10))  //if connRes == 0  "IDLE_STATUS - change Statius"
    {
      connRes  = WiFi.waitForConnectResult();
      delay(2000);
      i++;
      Serial.print(F("."));
      // statement(s)
    }
  while (( connRes == 1 ) and (i != 10))  //if connRes == 1  NO_SSID_AVAILin - SSID cannot be
reached
    {
      connRes  = WiFi.waitForConnectResult();
      delay(2000);
      i++;
      Serial.print(F("."));
      // statement(s)
    }
  if (connRes == 3 ) {
                    WiFi.setAutoReconnect(true); // Set whether module will attempt to reconnect to an
access point in case it is disconnected.
                    // Setup MDNS responder
                       if (!MDNS.begin(ESPHostname)) {
                          Serial.println(F("Error: MDNS"));
                          } else { MDNS.addService("http", "tcp", 80); }
                  }
  while (( connRes == 4 ) and (i != 10))  //if connRes == 4  Bad Password. Sometimes happens this
with corrct PWD
    {
      WiFi.begin(MyWiFiConfig.APSTAName, MyWiFiConfig.WiFiPwd);
      connRes = WiFi.waitForConnectResult();
      delay(3000);
      i++;
      Serial.print(F("."));
    }
  if (connRes == 4 ) {
                    Serial.println(F("STA Pwd Err"));
                    Serial.println(MyWiFiConfig.APSTAName);
                    Serial.println(MyWiFiConfig.WiFiPwd);
                    WiFi.disconnect();
                  }
  // if (connRes == 6 ) { Serial.println("DISCONNECTED - Not in station mode"); }
  // WiFi.printDiag(Serial);
Serial.println("");
return connRes;
}


#define SD_BUFFER_PIXELS 20


void handleFileUpload() {                              // Dateien vom Rechnenknecht oder Klingelkasten ins
SPIFFS schreiben
   if (server.uri() != "/upload") return;
   HTTPUpload& upload = server.upload();
   if (upload.status == UPLOAD_FILE_START) {
     String filename = upload.filename;
     if (upload.filename.length() > 30) {
      upload.filename = upload.filename.substring(upload.filename.length() - 30,
upload.filename.length());  // Dateinamen auf 30 Zeichen kürzen
    }
     Serial.println("FileUpload Name: " + upload.filename);
     if (!filename.startsWith("/")) filename = "/" + filename;
     //fsUploadFile = SPIFFS.open(filename, "w");
      fsUploadFile = SPIFFS.open("/" + server.urlDecode(upload.filename), "w");
     filename = String();
   } else if (upload.status == UPLOAD_FILE_WRITE) {
   //  Serial.print("handleFileUpload Data: "); Serial.println(upload.currentSize);
     if (fsUploadFile)
       fsUploadFile.write(upload.buf, upload.currentSize);
   } else if (upload.status == UPLOAD_FILE_END) {
     if (fsUploadFile)
       fsUploadFile.close();

   //  Serial.print("handleFileUpload Size: "); Serial.println(upload.totalSize);
   // server.sendContent(Header);
     handleDisplayFS();
   }
 }



void handleDisplayFS() {                    // HTML Filesystem
  //  Page: /filesystem
  temp ="";
  // HTML Header
  server.sendHeader("Cache-Control", "no-cache, no-store, must-revalidate");
  server.sendHeader("Pragma", "no-cache");
  server.sendHeader("Expires", "-1");
  server.setContentLength(CONTENT_LENGTH_UNKNOWN);
  // HTML Content
  server.send ( 200, "text/html", temp );
  temp += "<!DOCTYPE HTML><html lang='de'><head><meta charset='UTF-8'><meta name=
viewport content='width=device-width, initial-scale=1.0,'>";
```

```
  server.sendContent(temp);
  temp = "";
  temp += "<style type='text/css'><!-- DIV.container { min-height: 10em; display: table-cell; vertical-
align: middle }.button {height:35px; width:90px; font-size:16px}";
  server.sendContent(temp);
  temp = "";
  temp += "body {background-color: powderblue;}</style><head><title>File System
Manager</title></head>";
  temp += "<h2>Serial Peripheral Interface Flash Filesystem</h2><body><left>";
  server.sendContent(temp);
  temp = "";
  if (server.args() > 0) // Parameter wurden ubergeben
   {
     if (server.hasArg("delete"))
       {
        String FToDel = server.arg("delete");
        if (SPIFFS.exists(FToDel))
          {
           SPIFFS.remove(FToDel);
           temp += "File " + FToDel + " successfully deleted.";
          } else
          {
           temp += "File " + FToDel + " cannot be deleted.";
          }
        server.sendContent(temp);
        temp = "";
       }
     if (server.hasArg("format") and server.arg("on"))
       {
         SPIFFS.format();
         temp += "SPI File System successfully formatted.";
         server.sendContent(temp);
         temp = "";
       } //   server.client().stop(); // Stop is needed because we sent no content length
   }

  temp += "<table border=2 bgcolor = white width = 400 ><td><h4>Current SPIFFS Status: </h4>";
  temp += formatBytes(SPIFFS.usedBytes() * 1.05) + " of " + formatBytes(SPIFFS.totalBytes()) + "
used. <br>";
  temp += formatBytes((SPIFFS.totalBytes() - (SPIFFS.usedBytes() * 1.05)))+ " free. <br>";
  temp += "</td></table><br>";
  server.sendContent(temp);
  temp = "";
  // Check for Site Parameters

  temp += "<table border=2 bgcolor = white width = 400><tr><th><br>";
  temp += "<h4>Available Files on SPIFFS:</h4><table border=2 bgcolor = white
></tr></th><td>Filename</td><td>Size</td><td>Action </td></tr></th>";
  server.sendContent(temp);
  temp = "";
  File root = SPIFFS.open("/");
  File file = root.openNextFile();
  while (file)
  {
     temp += "<td> <a title=\"Download\" href =\"" + String(file.name()) + "\" download=\"" +
String(file.name()) + "\">" + String(file.name()) + "</a> <br></th>";
     temp += "<td>"+ formatBytes(file.size())+ "</td>";
     temp += "<td><a href =filesystem?delete=" + String(file.name()) + "> Delete </a></td>";
     temp += "</tr></th>";
     file = root.openNextFile();
  }


  temp += "</tr></th>";
  temp += "</td></tr></th><br></th></tr></table></table><br>";
  temp += "<table border=2 bgcolor = white width = 400 ><td><h4>Upload</h4>";

  temp += "<label> Choose File: </label>";
  temp += "<form method='POST' action='/upload' enctype='multipart/form-data'
style='height:35px;'><input type='file' name='upload' style='height:35px; font-size:13px;'
required>\r\n<input type='submit' value='Upload' class='button'></form>";
  temp += " </table><br>";
  server.sendContent(temp);
  temp = "";
  temp += "<td><a href =filesystem?format=on> Format SPIFFS Filesystem. (Takes up to 30
Seconds) </a></td>";
  temp += "<table border=2 bgcolor = white width = 500 cellpadding =5
><caption><p><h3>Systemlinks:</h2></p></caption><tr><th><br>";
  temp += " <a href='/'>Main Page</a><br><br></th></tr></table><br><br>";
  server.sendContent(temp);
  temp = "";
  temp += "<footer><p>Programmed and designed by: Tobias Kuch</p><p>Contact information: <a
href='mailto:tobias.kuch@googlemail.com'>tobias.kuch@googlemail.com</a>.</p></footer></bo
dy></html>";
  //server.send ( 200, "", temp );
  server.sendContent(temp);
  server.client().stop(); // Stop is needed because we sent no content length
  temp = "";
 }

/** Load WLAN credentials from EEPROM */

bool loadCredentials()
{
 bool RetValue;
 EEPROM.begin(512);
 EEPROM.get(0, MyWiFiConfig);
 EEPROM.end();
 if (String(MyWiFiConfig.ConfigValid) = String("TK"))
  {
    RetValue = true;
  } else
  {
    RetValue = false; // WLAN Settings not found.
  }
  return RetValue;
```

```
}


/** Store WLAN credentials to EEPROM */

bool saveCredentials()
{
bool RetValue;
// Check logical Errors
RetValue = true;
if  (MyWiFiConfig.APSTA == true ) //AP Mode
 {
  if (MyWiFiConfig.PwDReq and (sizeof(String(MyWiFiConfig.WiFiPwd)) < 8))
   {
     RetValue = false;  // Invalid Config
   }
  if (sizeof(String(MyWiFiConfig.APSTAName)) < 1)
   {
     RetValue = false;  // Invalid Config
   }
 }
if (RetValue)
 {
 EEPROM.begin(512);
 for (int i = 0 ; i < sizeof(MyWiFiConfig) ; i++)
    {
     EEPROM.write(i, 0);
    }
 strncpy( MyWiFiConfig.ConfigValid , "TK", sizeof(MyWiFiConfig.ConfigValid) );
 EEPROM.put(0, MyWiFiConfig);
 EEPROM.commit();
 EEPROM.end();
 }
 return RetValue;
}


void SetDefaultWiFiConfig()
{
  byte len;
  MyWiFiConfig.APSTA = true;
  MyWiFiConfig.PwDReq = true;  // default PW required
  MyWiFiConfig.CapPortal = true;
  strncpy( MyWiFiConfig.APSTAName, "ESP_Config", sizeof(MyWiFiConfig.APSTAName) );
  len = strlen(MyWiFiConfig.APSTAName);
  MyWiFiConfig.APSTAName[len+1] = '\0';
  strncpy( MyWiFiConfig.WiFiPwd, "12345678", sizeof(MyWiFiConfig.WiFiPwd) );
  len = strlen(MyWiFiConfig.WiFiPwd);
  MyWiFiConfig.WiFiPwd[len+1] = '\0';
  strncpy( MyWiFiConfig.ConfigValid, "TK", sizeof(MyWiFiConfig.ConfigValid) );
  len = strlen(MyWiFiConfig.ConfigValid);
  MyWiFiConfig.ConfigValid[len+1] = '\0';
  Serial.println(F("Reset WiFi Credentials."));
```

```
}



void handleRoot() {
//  Main Page:
 temp = "";
 byte PicCount = 0;
 byte ServArgs = 0;
  // HTML Header
  server.sendHeader("Cache-Control", "no-cache, no-store, must-revalidate");
  server.sendHeader("Pragma", "no-cache");
  server.sendHeader("Expires", "-1");
  server.setContentLength(CONTENT_LENGTH_UNKNOWN);
// HTML Content
  server.send ( 200, "text/html", temp );   // Speichersparen - Schon mal dem Cleint senden
  temp = "";
  temp += "<!DOCTYPE HTML><html lang='de'><head><meta charset='UTF-8'><meta name=
viewport content='width=device-width, initial-scale=1.0,'>";
  server.sendContent(temp);
  temp = "";
  temp += "<style type='text/css'><!-- DIV.container { min-height: 10em; display: table-cell; vertical-
align: middle }.button {height:35px; width:90px; font-size:16px}";
  server.sendContent(temp);
  temp = "";
  temp += "body {background-color: powderblue;}</style>";
  temp += "<head><title>Hauptseite</title></head>";
  temp += "<h2>Hauptseite</h2>";
  temp += "<body>";
  server.sendContent(temp);
  temp = "";
// Processing User Request
  temp = "";
  temp += "<table border=2 bgcolor = white width = 500 cellpadding =5
><caption><p><h3>Systemlinks:</h2></p></caption>";
  temp += "<tr><th><br>";
  temp += "<a href='/wifi'>WIFI Einstellungen</a><br><br>";
  temp += "<a href='/filesystem'>Filemanager</a><br><br>";
  temp += "</th></tr></table><br><br>";
  temp += "<footer><p>Programmed and designed by: Tobias Kuch</p><p>Contact information: <a
href='mailto:tobias.kuch@googlemail.com'>tobias.kuch@googlemail.com</a>.</p></footer>";
  temp += "</body></html>";
  server.sendContent(temp);
  temp = "";
  server.client().stop(); // Stop is needed because we sent no content length
}



void handleNotFound() {
    if (captivePortal())
      { // If caprive portal redirect instead of displaying the error page.
        return;
    }

  if (!handleFileRead(server.uri()))
    {
    temp = "";
    // HTML Header
    server.sendHeader("Cache-Control", "no-cache, no-store, must-revalidate");
    server.sendHeader("Pragma", "no-cache");
    server.sendHeader("Expires", "-1");
    server.setContentLength(CONTENT_LENGTH_UNKNOWN);
    // HTML Content
    temp += "<!DOCTYPE HTML><html lang='de'><head><meta charset='UTF-8'><meta name=
viewport content='width=device-width, initial-scale=1.0,'>";
    temp += "<style type='text/css'><!-- DIV.container { min-height: 10em; display: table-cell;
vertical-align: middle }.button {height:35px; width:90px; font-size:16px}";
    temp += "body {background-color: powderblue;}</style>";
    temp += "<head><title>File not found</title></head>";
    temp += "<h2> 404 File Not Found</h2><br>";
    temp += "<h4>Debug Information:</h4><br>";
    temp += "<body>";
    temp += "URI: ";
    temp += server.uri();
    temp += "\nMethod: ";
    temp+= ( server.method() == HTTP_GET ) ? "GET" : "POST";
    temp += "<br>Arguments: ";
    temp += server.args();
    temp += "\n";
      for ( uint8_t i = 0; i < server.args(); i++ ) {
        temp += " " + server.argName ( i ) + ": " + server.arg ( i ) + "\n";
        }
    temp += "<br>Server Hostheader: "+ server.hostHeader();
    for ( uint8_t i = 0; i < server.headers(); i++ ) {
        temp += " " + server.headerName ( i ) + ": " + server.header ( i ) + "\n<br>";
        }
    temp += "</table></form><br><br><table border=2 bgcolor = white width = 500 cellpadding =5
><caption><p><h2>You may want to browse to:</h2></p></caption>";
    temp += "<tr><th>";
    temp += "<a href='/'>Main Page</a><br>";
    temp += "<a href='/wifi'>WIFI Settings</a><br>";
    temp += "<a href='/filesystem'>Filemanager</a><br>";
    temp += "</th></tr></table><br><br>";
    temp += "<footer><p>Programmed and designed by: Tobias Kuch</p><p>Contact information:
<a href='mailto:tobias.kuch@googlemail.com'>tobias.kuch@googlemail.com</a>.</p></footer>";
    temp += "</body></html>";
    server.send ( 404, "", temp );
    server.client().stop(); // Stop is needed because we sent no content length
    temp = "";
    }
}
```

```
/** Redirect to captive portal if we got a request for another domain. Return true in that case so
the page handler do not try to handle the request again. */
boolean captivePortal() {
  if (!isIp(server.hostHeader()) && server.hostHeader() != (String(ESPHostname)+".local")) {
    // Serial.println("Request redirected to captive portal");
    server.sendHeader("Location", String("http://") + toStringIp(server.client().localIP()), true);
    server.send ( 302, "text/plain", ""); // Empty content inhibits Content-length header so we have
to close the socket ourselves.
    server.client().stop(); // Stop is needed because we sent no content length
    return true;
  }
  return false;
}



/** Wifi config page handler */
void handleWifi()
 {
  //  Page: /wifi
  byte i;
  byte len ;
  temp = "";
  // Check for Site Parameters
      if (server.hasArg("Reboot") )  // Reboot System
       {
         temp = "Rebooting System in 5 Seconds..";
         server.send ( 200, "text/html", temp );
         delay(5000);
         server.client().stop();
         WiFi.disconnect();
         delay(1000);
       }

      if (server.hasArg("WiFiMode") and (server.arg("WiFiMode") == "1")  )  // STA Station Mode
Connect to another WIFI Station
       {
        startMillis = millis(); // Reset Time Up Counter to avoid Idle Mode whiole operating
        // Connect to existing STATION
        if ( sizeof(server.arg("WiFi_Network")) > 0  )
          {
            Serial.println("STA Mode");
            MyWiFiConfig.APSTA = false; // Access Point or Station Mode - false Station Mode
            temp = "";
            for ( i = 0; i < APSTANameLen;i++) { MyWiFiConfig.APSTAName[i] =  0; }
            temp = server.arg("WiFi_Network");
            len =  temp.length();
            for ( i = 0; i < len;i++)
            {
                 MyWiFiConfig.APSTAName[i] =  temp[i];
            }
            temp = "";
            for ( i = 0; i < WiFiPwdLen;i++)  { MyWiFiConfig.WiFiPwd[i] =  0; }
            temp = server.arg("STAWLanPW");
            len =  temp.length();
            for ( i = 0; i < len;i++)
             {
               if (temp[i] > 32) //Steuerzeichen raus
                 {
                  MyWiFiConfig.WiFiPwd[i] =  temp[i];
                 }
             }
            temp = "WiFi Connect to AP: -";
            temp += MyWiFiConfig.APSTAName;
            temp += "-<br>WiFi PW: -";
            temp += MyWiFiConfig.WiFiPwd;
            temp += "-<br>";
            temp += "Connecting to STA Mode in 2 Seconds..<br>";
            server.send ( 200, "text/html", temp );
            server.sendContent(temp);
            delay(2000);
            server.client().stop();
            server.stop();
            temp = "";
            WiFi.disconnect();
            WiFi.softAPdisconnect(true);
            delay(500);
           // ConnectWifiAP
           bool SaveOk = saveCredentials();
            i = ConnectWifiAP();
            delay(700);
            if (i != 3) // 4: WL_CONNECT_FAILED - Password is incorrect 1: WL_NO_SSID_AVAILin -
Configured SSID cannot be reached
             {
               Serial.print(F("Cannot Connect to specified Network. Reason: "));
               Serial.println(i);
               server.client().stop();
               delay(100);
               WiFi.setAutoReconnect (false);
               delay(100);
               WiFi.disconnect();
               delay(1000);
               SetDefaultWiFiConfig();
               CreateWifiSoftAP();
               return;
             } else
             {
               // Safe Config
               bool SaveOk = saveCredentials();
               InitalizeHTTPServer();
               return;
             }
          }
       }
```

```
    if (server.hasArg("WiFiMode") and (server.arg("WiFiMode") == "2")  )  // Change AP Mode
     {
      startMillis = millis(); // Reset Time Up Counter to avoid Idle Mode whiole operating
      // Configure Access Point
      temp = server.arg("APPointName");
      len =  temp.length();
      temp =server.arg("APPW");
      if (server.hasArg("PasswordReq"))
        {
         i =  temp.length();
        } else { i = 8; }

      if (  ( len > 1 ) and (server.arg("APPW") == server.arg("APPWRepeat")) and ( i > 7)          )
       {
        temp = "";
        Serial.println(F("APMode"));
        MyWiFiConfig.APSTA = true; // Access Point or Sation Mode - true AP Mode

        if (server.hasArg("CaptivePortal"))
        {
         MyWiFiConfig.CapPortal = true ; //CaptivePortal on in AP Mode
        } else { MyWiFiConfig.CapPortal = false ; }

        if (server.hasArg("PasswordReq"))
        {
         MyWiFiConfig.PwDReq = true ; //Password Required in AP Mode
        } else { MyWiFiConfig.PwDReq = false ; }

        for ( i = 0; i < APSTANameLen;i++) { MyWiFiConfig.APSTAName[i] =  0; }
        temp = server.arg("APPointName");
        len =  temp.length();
        for ( i = 0; i < len;i++) { MyWiFiConfig.APSTAName[i] =  temp[i]; }
        MyWiFiConfig.APSTAName[len+1] = '\0';
        temp = "";
        for ( i = 0; i < WiFiPwdLen;i++)  {  MyWiFiConfig.WiFiPwd[i] =  0; }
        temp = server.arg("APPW");
        len =  temp.length();
        for ( i = 0; i < len;i++)  { MyWiFiConfig.WiFiPwd[i] =  temp[i];  }
        MyWiFiConfig.WiFiPwd[len+1] = '\0';
        temp = "";
        if (saveCredentials()) // Save AP ConfigCongfig
         {
                temp = "Daten des AP Modes erfolgreich gespeichert. Reboot notwendig.";
         } else  { temp = "Daten des AP Modes fehlerhaft.";  }
       } else if (server.arg("APPW") != server.arg("APPWRepeat"))
           {
            temp = "";
            temp = "WLAN Passwort nicht gleich. Abgebrochen.";
           } else
           {
            temp = "";
            temp = "WLAN Passwort oder AP Name zu kurz. Abgebrochen.";
           }
     }

  // HTML Header
  server.sendHeader("Cache-Control", "no-cache, no-store, must-revalidate");
  server.sendHeader("Pragma", "no-cache");
  server.sendHeader("Expires", "-1");
  server.setContentLength(CONTENT_LENGTH_UNKNOWN);
// HTML Content
  temp += "<!DOCTYPE HTML><html lang='de'><head><meta charset='UTF-8'><meta name=
viewport content='width=device-width, initial-scale=1.0,'>";
  server.send ( 200, "text/html", temp );
  temp = "";
  temp += "<style type='text/css'><!-- DIV.container { min-height: 10em; display: table-cell; vertical-
align: middle }.button {height:35px; width:90px; font-size:16px}";
  temp += "body {background-color: powderblue;}</style><head><title>Smartes Tuerschild - WiFi
Settings</title></head>";
  server.sendContent(temp);
  temp = "";
  temp += "<h2>WiFi Einstellungen</h2><body><left>";
  temp += "<table border=2 bgcolor = white width = 500 ><td><h4>Current WiFi Settings: </h4>";
  if (server.client().localIP() == apIP) {
    temp += "Mode : Soft Access Point (AP)<br>";
    temp += "SSID : " + String (MyWiFiConfig.APSTAName) + "<br><br>";
  } else {
    temp += "Mode : Station (STA) <br>";
    temp += "SSID  :  "+ String (MyWiFiConfig.APSTAName) + "<br>";
    temp += "BSSID :  " + WiFi.BSSIDstr()+ "<br><br>";
  }
  temp += "</td></table><br>";
  server.sendContent(temp);
  temp = "";
  temp += "<form action='/wifi' method='post'>";
  temp += "<table border=2 bgcolor = white width = 500><tr><th><br>";
  if (MyWiFiConfig.APSTA == 1)
    {
     temp += "<input type='radio' value='1' name='WiFiMode' > WiFi Station Mode<br>";
    } else
    {
     temp += "<input type='radio' value='1' name='WiFiMode' checked > WiFi Station Mode<br>";
    }
  temp += "Available WiFi Networks:<table border=2 bgcolor = white ></tr></th><td>Number
</td><td>SSID  </td><td>Encryption </td><td>WiFi Strength </td>";
  server.sendContent(temp);
  temp = "";
  WiFi.scanDelete();
  int n = WiFi.scanNetworks(false, false); //WiFi.scanNetworks(async, show_hidden)
  if (n > 0) {
    for (int i = 0; i < n; i++) {
    temp += "</tr></th>";
    String Nrb = String(i);
    temp += "<td>" + Nrb + "</td>";
    temp += "<td>" + WiFi.SSID(i) +"</td>";

    Nrb = GetEncryptionType(WiFi.encryptionType(i));
    temp += "<td>"+ Nrb + "</td>";
    temp += "<td>" + String(WiFi.RSSI(i)) + "</td>";
    }
  } else {
    temp += "</tr></th>";
    temp += "<td>1 </td>";
    temp += "<td>No WLAN found</td>";
    temp += "<td> --- </td>";
    temp += "<td> --- </td>";
  }
  temp += "</table><table border=2 bgcolor = white ></tr></th><td>Connect to WiFi SSID: 
</td><td><select name='WiFi_Network' >";
if (n > 0) {
    for (int i = 0; i < n; i++) {
    temp += "<option value='" + WiFi.SSID(i) +"'>" + WiFi.SSID(i) +"</option>";
    }
  } else {
    temp += "<option value='No_WiFi_Network'>No WiFiNetwork found !/option>";
  }
  server.sendContent(temp);
  temp = "";
  temp += "</select></td></tr></th></tr></th><td>WiFi Password: </td><td>";
  temp += "<input type='text' name='STAWLanPW' maxlength='40' size='40'>";
  temp += "</td></tr></th><br></th></tr></table></table><table border=2 bgcolor = white width 
= 500 ><tr><th><br>";
  server.sendContent(temp);
  temp = "";
  if (MyWiFiConfig.APSTA == true)
    {
      temp += "<input type='radio' name='WiFiMode' value='2' checked> WiFi Access Point Mode 
<br>";
    } else
    {
      temp += "<input type='radio' name='WiFiMode' value='2' > WiFi Access Point Mode <br>";
    }
  temp += "<table border=2 bgcolor = white ></tr></th> <td>WiFi Access Point Name: </td><td>";
  server.sendContent(temp);
  temp = "";
  if (MyWiFiConfig.APSTA == true)
    {
      temp += "<input type='text' name='APPointName' maxlength='"+String(APSTANameLen-1)+"' 
size='30' value='" + String(MyWiFiConfig.APSTAName) + "'></td>";
    } else
    {
      temp += "<input type='text' name='APPointName' maxlength='"+String(APSTANameLen-1)+"' 
size='30' ></td>";
    }
  server.sendContent(temp);
  temp = "";
  if (MyWiFiConfig.APSTA == true)
    {
      temp += "</tr></th><td>WiFi Password: </td><td>";
      temp += "<input type='password' name='APPW' maxlength='"+String(WiFiPwdLen-1)+"'
size='30' value='" + String(MyWiFiConfig.WiFiPwd) + "'> </td>";
      temp += "</tr></th><td>Repeat WiFi Password: </td>";
      temp += "<td><input type='password' name='APPWRepeat' maxlength='"+String(WiFiPwdLen-
1)+"' size='30' value='" + String(MyWiFiConfig.WiFiPwd) + "'> </td>";
    } else
    {
      temp += "</tr></th><td>WiFi Password: </td><td>";
      temp += "<input type='password' name='APPW' maxlength='"+String(WiFiPwdLen-1)+"'
size='30'> </td>";
      temp += "</tr></th><td>Repeat WiFi Password: </td>";
      temp += "<td><input type='password' name='APPWRepeat' maxlength='"+String(WiFiPwdLen-
1)+"' size='30'> </td>";
    }
      temp += "</table>";
  server.sendContent(temp);
  temp = "";
  if (MyWiFiConfig.PwDReq)
    {
      temp += "<input type='checkbox' name='PasswordReq' checked> Password for Login required.
";
    } else
    {
      temp += "<input type='checkbox' name='PasswordReq' > Password for Login required. ";
    }
  server.sendContent(temp);
  temp = "";
  if (MyWiFiConfig.CapPortal)
    {
      temp += "<input type='checkbox' name='CaptivePortal' checked> Activate Captive Portal";
    } else
    {
      temp += "<input type='checkbox' name='CaptivePortal' > Activate Captive Portal";
    }
  server.sendContent(temp);
  temp = "";
  temp += "<br></tr></th></table><br> <button type='submit' name='Settings' value='1'
style='height: 50px; width: 140px' autofocus>Set WiFi Settings</button>";
  temp += "<button type='submit' name='Reboot' value='1' style='height: 50px; width: 200px'
>Reboot System</button>";
  server.sendContent(temp);
  temp = "";
  temp += "<button type='reset' name='action' value='1' style='height: 50px; width: 100px'
>Reset</button></form>";
  temp += "<table border=2 bgcolor = white width = 500 cellpadding =5
><caption><p><h3>Systemlinks:</h2></p></caption><tr><th><br>";
  server.sendContent(temp);
  temp = "";
  temp += "<a href='/'>Main Page</a><br><br></th></tr></table><br><br>";
  //temp += "<footer><p>Programmed and designed by: Tobias Kuch</p><p>Contact information: 
<a href='mailto:tobias.kuch@googlemail.com'>tobias.kuch@googlemail.com</a>.</p></footer>";
  temp += "</body></html>";
  server.sendContent(temp);
  server.client().stop(); // Stop is needed because we sent no content length
  temp = "";
}


void handleUploadSave()
{
  String FileData ;
  temp = "";
  //server.send(200);
  //Serial.println("FileUpload");
  //Serial.println(server.args());
  for (byte i = 0; i < server.args(); i++)
  {
    temp += "Arg " + (String)i + " –> ";   //Include the current iteration value
    temp += server.argName(i) + ": ";     //Get the name of the parameter
    temp += server.arg(i) + "\n";             //Get the value of the parameter
  }
  // server.send(200, "text/plain", temp);       //Response to the HTTP request
  FileData = server.arg("datei");
  server.sendHeader("Location", "filesystem", true);
  server.sendHeader("Cache-Control", "no-cache, no-store, must-revalidate");
  server.sendHeader("Pragma", "no-cache");
  server.sendHeader("Expires", "-1");
  server.send ( 302, "text/plain", "");  // Empty content inhibits Content-length header so we have 
to close the socket ourselves.
  server.client().stop(); // Stop is needed because we sent no content length
}


/** Is this an IP? */
boolean isIp(String str) {
  for (int i = 0; i < str.length(); i++) {
    int c = str.charAt(i);
    if (c != '.' && (c < '0' || c > '9')) {
      return false;
    }
  }
  return true;
}

String GetEncryptionType(byte thisType) {
  String Output = "";
   // read the encryption type and print out the name:
   switch (thisType) {
     case 5:
       Output = "WEP";
       return Output;
       break;
    case 2:
      Output = "WPA";
      return Output;
      break;
    case 4:
      Output = "WPA2";
      return Output;
      break;
    case 7:
      Output = "None";
      return Output;
      break;
    case 8:
      Output = "Auto";
      return Output;
     break;
  }
}

/** IP to String? */
String toStringIp(IPAddress ip) {
  String res = "";
  for (int i = 0; i < 3; i++) {
    res += String((ip >> (8 * i)) & 0xFF) + ".";
  }
  res += String(((ip >> 8 * 3)) & 0xFF);
  return res;
}

String formatBytes(size_t bytes) {           // lesbare Anzeige der Speichergrößen
   if (bytes < 1024) {
     return String(bytes) + " Byte";
   } else if (bytes < (1024 * 1024)) {
     return String(bytes / 1024.0) + " KB";
   } else if (bytes < (1024 * 1024 * 1024)) {
     return String(bytes / 1024.0 / 1024.0) + " MB";
   }
 }

String getContentType(String filename) { // convert the file extension to the MIME type
  if (filename.endsWith(".htm")) return "text/html";
  else if (filename.endsWith(".css")) return "text/css";
  else if (filename.endsWith(".js")) return "application/javascript";
  else if (filename.endsWith(".ico")) return "image/x-icon";
  else if (filename.endsWith(".gz")) return "application/x-gzip";
  else if (filename.endsWith(".bmp")) return "image/bmp";
  else if (filename.endsWith(".tif")) return "image/tiff";
  else if (filename.endsWith(".pbm")) return "image/x-portable-bitmap";
  else if (filename.endsWith(".jpg")) return "image/jpeg";
  else if (filename.endsWith(".gif")) return "image/gif";
  else if (filename.endsWith(".png")) return "image/png";
  else if (filename.endsWith(".svg")) return "image/svg+xml";
  else if (filename.endsWith(".html")) return "text/html";
  else if (filename.endsWith(".wav")) return "audio/x-wav";
  else if (filename.endsWith(".zip")) return "application/zip";
  else if (filename.endsWith(".rgb")) return "image/x-rg";
 // Complete List on https://wiki.selfhtml.org/wiki/MIME-Type/Übersicht
  return "text/plain";
}

bool handleFileRead(String path) { // send the right file to the client (if it exists)
//  Serial.println("handleFileRead: " + path);
  if (path.endsWith("/")) path += "index.html";          // If a folder is requested, send the index file
  String contentType = getContentType(path);             // Get the MIME type
  String pathWithGz = path + ".gz";
  if (SPIFFS.exists(pathWithGz) || SPIFFS.exists(path)) { // If the file exists, either as a compressed
archive, or normal
    if (SPIFFS.exists(pathWithGz))                       // If there's a compressed version available
      path += ".gz";                                     // Use the compressed verion
    File file = SPIFFS.open(path, "r");                  // Open the file
    size_t sent = server.streamFile(file, contentType);    // Send it to the client
    file.close();                                        // Close the file again
    return true;
  }
  return false;
}

void loop()
 {
  if (SoftAccOK)
  {
    dnsServer.processNextRequest(); //DNS
  }
  //HTTP
  server.handleClient();
  }
```

Ich wünsche viel Spaß mit dem Fileserver auf dem ESP32. Im nächsten Teil schauen wir uns an, wie man auf dem Fileserver abgelegten BMP Bildern auf LED Matrix Displays ausgeben kann.

Bis zum nächsten Mal !