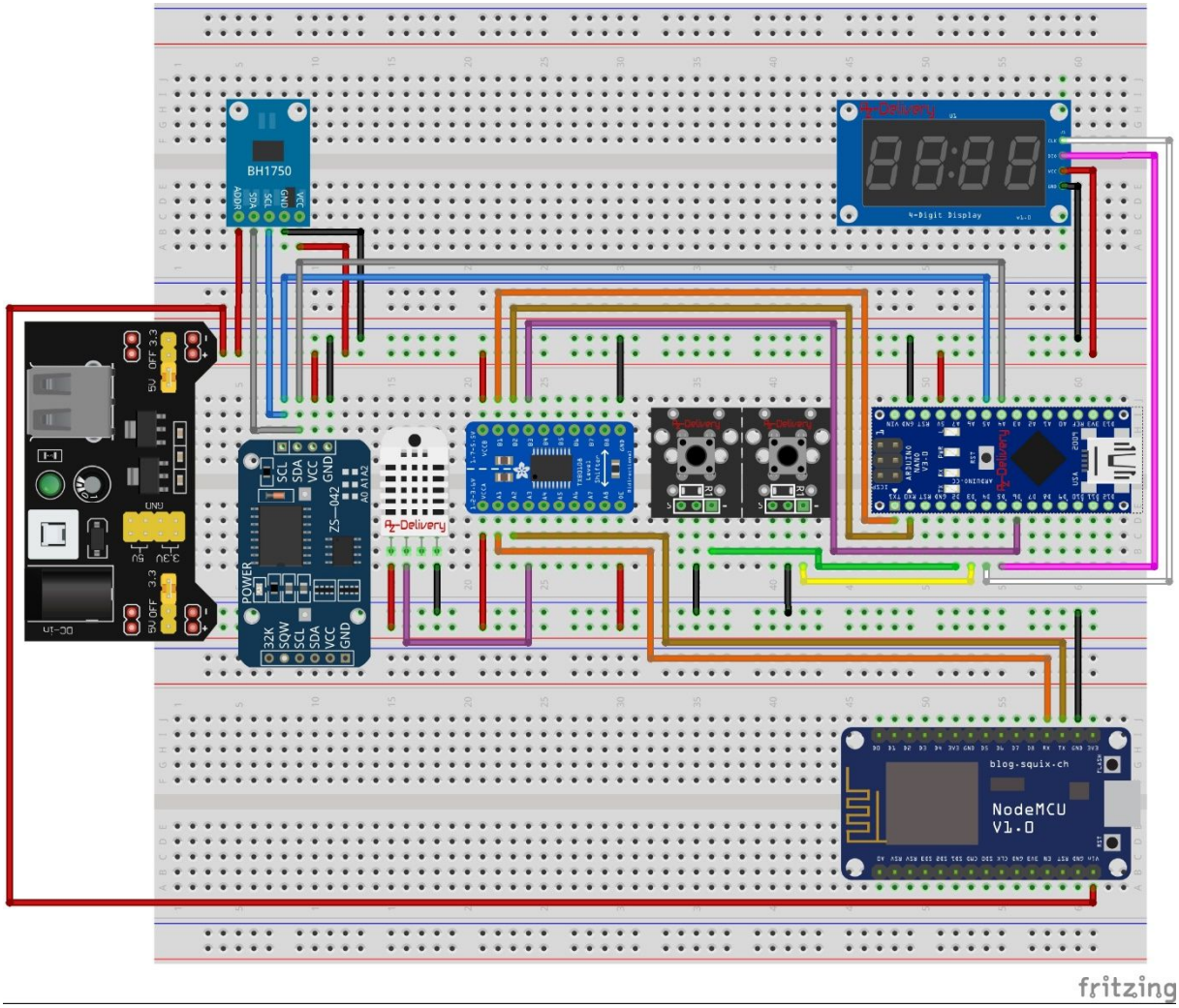
LED Echtzeituhr mit RTC Modul, alternierender Temperatur in Celsius und Fahrenheit, Luftfeuchteanzeige, Helligkeitssteuerung und Netzwerksyc. (Teil 5)

Hallo und Willkommen zu dem letzten Teil unserer Digitaluhr Reihe. In diesem Teil runden wir die Features rund um unsere Uhr nun ab und kümmern uns um eine Synchronisation der Uhrzeit mithilfe des NTP Protokolls aus dem Internet. Dazu verwenden wir einen preiswerten ESP8266, der die Verbindung zu einem Zeitserver im Internet beim Starten des Systems und alle 48 Stunden herstellt, um die aktuelle Uhrzeit per RS232 Protokoll mit 115200 Baud an den Arduino Nano zu übertragen. Dieser speichert die Uhrzeit dann selbst wiederum in das RTC Modul ab, das als interne Zeitreferenz genutzt wird. Der große Vorteil dieses auf den ersten Blick doppelte Verfahren im Gegensatz zu der permanenten Gewinnung der Zeit aus dem Netz besteht in der Unabhängigkeit bzw. der Ausfallsicherheit. Denn selbst, wenn das Internet mal nicht zur Verfügung stehen sollte, läuft unsere Uhr unbeeindruckt weiter und ist darüber hinaus vom Internet ansonsten unabhängig. (Ganz im Gegensatz zu vielen Smarthome Gadgets heutzutage 😊)

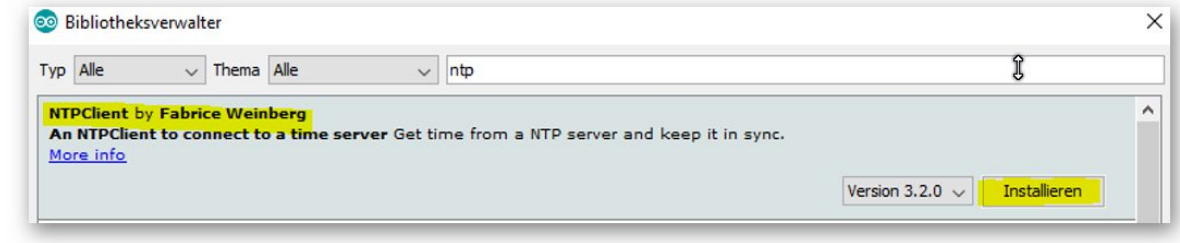
Wir brauchen für den finalen letzten Teil folgende Teileliste:

Anzahl	Beschreibung	Anmerkung
1	DHT 22	
	DHT 11	Alternativ zu DHT 22
2	KY-004 Button Module	
1	Nano V3	
1	4 Digit 7 Segment Display (TM1637)	
1	MB102 Netzteil Adapter	Für Breadboardaufbau
1	Logic Level Converter TXS0108E	
1	Real Time Clock RTC DS3231	I2C Echtzeituhr für Arduino
1	ESP8266	

Da wir nun ein Multiprozessorboard bauen, bei dem 2 Prozessoren mithilfe einer Schnitstelle kommunizieren brauchen wir auf unserem Board nun etwas mehr Platz und bauen die Teile wie gezeigt auf:



Wichtig ist, auf die korrekte Verdrahtung der beiden unterschiedlichen Spannungsbereiche 5 Volt und 3,3, Volt zu achten. Sobal die Hardware fertig ist, kann es an die Software der beiden uC gehen. Zunächst jedoch binden wir zur nutzung des NTP Zeitprotokolls noch die Bibliothek „NTPClient“ von Fabrice Weinberg.



Im heutigen Teil haben wir zwei verschiedene Firmware Codes für die jeweiligen Microcontroller. Der erste Code ist für den ESP8266, der als NTP Client fugieren soll. Es müssen jeweils noch die eigenen WLAN Credentials eingefügt werden:

```
#include <NTPClient.h>
#include <ESP8266WiFi.h>
#include <WiFiUdp.h>

const char *ssid     = "Deine WLAN SSID";
const char *password = " Dein WLAN Passwort";
const long utcOffsetInSeconds = 3600;
const long delayseconds = 172800; // 48 Stunden

long elapsedSeconds = 0;

// Define NTP Client to get time
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP, "pool.ntp.org", utcOffsetInSeconds);

void setup(){
  delay(1000);
  Serial.begin(115200);
  delay(2000);
  Serial.flush();
  WiFi.begin(ssid, password);
  while ( WiFi.status() != WL_CONNECTED ) {
    delay ( 500 );
    yield();
  }
  timeClient.begin();
  SetNTPTime_toClock();
  delay(500);
  SetNTPTime_toClock();
  delay(500);
  SetNTPTime_toClock();
}

void SetNTPTime_toClock()
{
  timeClient.update();
  Serial.write(116);
  Serial.write(13);
  Serial.print(timeClient.getHours());
  Serial.write(13);
  Serial.print(timeClient.getMinutes());
  Serial.write(13);
  Serial.print(timeClient.getSeconds());
  Serial.write(13);
  Serial.flush();
}
```

```
void loop() {
 delay(1000);
 elapsedSeconds++;
 if (elapsedSeconds >= delayseconds && WiFi.status() == WL_CONNECTED )
  {
   elapsedSeconds = 0;
   SetNTPTime_toClock();
  }
 yield();
}
```

Code für den Nano:

```
// Code by Tobias Kuch 2019, Licesed unter GPL 3.0

#include <TM1637.h>
#include "DHT.h"    // REQUIRES the following Arduino libraries:
              //- DHT Sensor Library: https://github.com/adafruit/DHT-sensor-library
              //- Adafruit Unified Sensor Lib: https://github.com/adafruit/Adafruit_Sensor
#include <Wire.h>
// Instantiation and pins configurations
// Pin 4 - > CLK
// Pin 5 - > DIO
TM1637 tm1637(4, 5);
#define BUTTON_MINUTEUP_PIN   2    // Digital IO pin connected to the button.  This will be
                  // driven with a pull-up resistor so the switch should
                  // pull the pin to ground momentarily.  On a high -> low
                  // transition the button press logic will execute.
                  // Used for Setting the Clock Time

#define BUTTON_HOURUP_PIN   3    // Digital IO pin connected to the button.  This will be
                  // driven with a pull-up resistor so the switch should
                  // pull the pin to ground momentarily.  On a high -> low
                  // transition the button press logic will execute.
                  // Used for Setting the Clock Time
//DHT Konfiguration
#define DHTPIN 6                      // Digital pin connected to the DHT sensor
#define DHTTYPE DHT22                    // DHT 22  (AM2302), AM2321
#define DS3231_I2C_ADDRESS 0x68
#define MaxInputBufferSize 5 // maximal 255 Zeichen anpassen an vlcdr

DHT dht(DHTPIN, DHTTYPE); // DHT Sensor Instanz initalisieren


struct BHLightSensorData
 {
  int Lux = 0 ;        // Lichtstärke in Lux
  int Old_Lux = 0 ;     // Lichtstärke in Lux
  bool DataValid  = false;
  bool SensorEnabled  = false;
 };
```

```
//Serial Input Handling
char TBuffer;
char Cbuffer[MaxInputBufferSize+1];      //USB Code Input Buffer
String Sbuffer = "";                     //USB String Input Buffer
int value;                               //USB Nummeric Input Buffer
byte Ccount { 0 };                       //Number received Chars
byte Inptype = 0;
boolean StrInput = false;
boolean NumberInput = false;
boolean DataInput = false;
boolean EnterInput = false;
byte MenueSelection = 0;
byte MnuState = 0;          // Maximale Menuetiefe 255 icl Sub

// interrupt Control
bool SecInterruptOccured = true;
bool A60telSecInterruptOccured = true;
byte A60telSeconds24 = 0;

// Clock Variables
byte Seconds24;
byte Minutes24 ;
byte Hours24;
byte Displayalternation = 22;
bool DisableSecondDisplay = false;
bool MinSetQuickTime = false;
bool HourSetQuickTime = false;
bool ButtonDPress = false;
bool ButtonEPress = false;


BHLightSensorData BHMeasure;
byte BH1750I2CAddress = 0;                  // Detected BH1750 I2C Address

//Interrupt Routines
ISR(TIMER1_COMPA_vect)
{
 A60telSeconds24++;
 if ((A60telSeconds24 > 59) and !(MinSetQuickTime))
  {
    A60telSeconds24 = 0;
   //Calculate Time 24 Stunden Format
   SecInterruptOccured = true;
   Seconds24++;
   if (Seconds24 > 59)
    {
      Seconds24 = 0;
      Minutes24++;
    }
   if (Minutes24 > 59)
    {
      Minutes24 = 0;
```

```
        Hours24++;
       }
     if (Hours24 > 23)
       {
        Hours24 = 0;
       }
   }
   if  (MinSetQuickTime)
   {
      A60telSeconds24 = 0;
     //Calculate Time 24 h Format
     SecInterruptOccured = true;
     Seconds24++;
     if (Seconds24 > 59)
       {
        Seconds24 = 0;
        Minutes24++;
       }
     if (Minutes24 > 59)
       {
        Minutes24 = 0;
        Hours24++;
       }
     if (Hours24 > 23)
       {
        Hours24 = 0;
       }
   }
  TCNT1 = 0;      // Register mit 0 initialisieren
if  (HourSetQuickTime)
   {
    OCR1A =  200;
   } else
   {
    OCR1A =  33353;     // Output Compare Register vorbelegen
   }
  A60telSecInterruptOccured = true;
}

//Interrupts ende
void CheckConfigButtons ()    // InterruptRoutine
{
bool PressedZ;
PressedZ= digitalRead(BUTTON_MINUTEUP_PIN);
if ((PressedZ == LOW) and (ButtonDPress == false))
  {
   ButtonDPress = true;
   delay(100);
   Minutes24++;
   Seconds24 = 0;  // Reset Seconds to zero to avoid Randomly time
   DisableSecondDisplay = true ;   // Disable Seconds While Clock Set
   MinSetQuickTime = true; //Enable Quick Tmime Passby
  }
```

```
if ((PressedZ == HIGH) and (ButtonDPress == true))
  {
  ButtonDPress = false;
  delay(100);
  DisableSecondDisplay = false ;   // Enable Seconds While Clock Set
  MinSetQuickTime = false;
  Seconds24 = 0;  // Reset Seconds to zero to avoid Randomly time
  A60telSeconds24 = 0;
  setDS3231time( Seconds24,Minutes24,Hours24,1,24,6,77);
  }
PressedZ= digitalRead(BUTTON_HOURUP_PIN);
if ((PressedZ == LOW) and (ButtonEPress == false))
  {
    ButtonEPress = true;
    delay(100);
    DisableSecondDisplay = true ;   // Disable Seconds While Clock Set
    MinSetQuickTime = true; //Enable Quick Tmime Passby
    HourSetQuickTime = true;
  }
if ((PressedZ == HIGH) and (ButtonEPress == true))
  {
    noInterrupts();   // deactivate Interrupts
    ButtonEPress = false;
    delay(100);
    Minutes24++;
    DisableSecondDisplay = false ;   // Enable Seconds While Clock Set
    MinSetQuickTime = false; //Enable Quick Tmime Passby
    HourSetQuickTime = false;
    Seconds24 = 0;  // Reset Seconds to zero to avoid Randomly time
    A60telSeconds24 = 0;
    interrupts();   // enable all Interrupts
    setDS3231time( Seconds24,Minutes24,Hours24,1,24,6,77);
  }
}

void setup()
{
   tm1637.init();
   Serial.begin(115200);
   Serial.flush();
   pinMode(BUTTON_MINUTEUP_PIN, INPUT_PULLUP);
   pinMode(BUTTON_HOURUP_PIN, INPUT_PULLUP);
   digitalWrite(LED_BUILTIN, LOW);
   noInterrupts();
   TCCR1A = 0x00;
   TCCR1B =  0x02;
   TCNT1 = 0;      // Register mit 0 initialisieren
   OCR1A =  33353;     // Output Compare Register vorbelegen
   TIMSK1 |= (1 << OCIE1A);  // Timer Compare Interrupt aktivieren
   interrupts();
   Seconds24 = 1;
   Minutes24 = 1;
   Hours24 = 0;
```

```
   dht.begin();
   Wire.begin();
   readDS3231time(&Seconds24,&Minutes24,&Hours24);
   BHMeasure.SensorEnabled = Run_BH1750Sensor(true); // Init
   if (BHMeasure.SensorEnabled)
   {
    Run_BH1750Sensor(false);
    delay(200);
    Run_BH1750Sensor(false);
   } else
   {
    tm1637.setBrightness (8);
   }
}

bool Run_BH1750Sensor (bool Init)   // Runtime Funktion für den BH170 Lichtsensor
{
byte ec;
 if (Init)
   {
   bool BH1750Detected = false;
   Wire.beginTransmission(35);
   ec=Wire.endTransmission(true);
   if(ec==0)
    {
    BH1750Detected = true;
    BH1750I2CAddress = 35; // BH1750 I2C Adresse ist DEC 35
    } else
    {
    Wire.beginTransmission(92);
    ec=Wire.endTransmission(true);
    if(ec==0)
     {
     BH1750Detected = true;
     BH1750I2CAddress = 92; // BH1750 I2C Adresse ist DEC 92
     }
    }
   if (BH1750Detected)
    {
    // Intialize Sensor
    Wire.beginTransmission(BH1750I2CAddress);
    Wire.write(0x01);   // Turn it on before we can reset it
    Wire.endTransmission();
    Wire.beginTransmission(BH1750I2CAddress);
    Wire.write(0x07);   // Reset
    Wire.endTransmission();
    Wire.beginTransmission(BH1750I2CAddress);
    Wire.write(0x10);   // Continuously H-Resolution Mode ( 1 lux Resolution) Weitere Modis
möglich, gemäß Datenblatt
    //Wire.write(0x11);  // Continuously H-Resolution Mode 2 ( 0.5 lux Resolution)
    //Wire.write(0x20);  // One Time H-Resolution Mode  ( 1 lux Resolution)
    //Wire.write(0x21);  // One Time H-Resolution Mode2 ( 0.5 lux Resolution)
    Wire.endTransmission();
```

```
    } else
    {
    return BH1750Detected;
    }
   }
  Wire.beginTransmission(BH1750I2CAddress);
  ec=Wire.endTransmission(true);
  if(ec==0)
   {
   Wire.requestFrom(BH1750I2CAddress, 2);
   BHMeasure.Lux = Wire.read();
   BHMeasure.Lux <<= 8;              // Verschieben der unteren 8 Bits in die höhreren 8 Bits der 16
Bit breiten Zahl
   BHMeasure.Lux |= Wire.read();
   BHMeasure.Lux = BHMeasure.Lux / 1.2;
   BHMeasure.DataValid = true;
   if (BHMeasure.Lux != BHMeasure.Old_Lux)
    {
    BHMeasure.Old_Lux = BHMeasure.Lux;
   //  Serial.print ("Lichtstärke in Lux :");
   //  Serial.println (BHMeasure.Lux);
   //  Serial.println (TM1637Brightness);
    int TM1637Brightness =  map(BHMeasure.Lux, 300,0, 8, 0);
    if ((BHMeasure.Lux > 10) && (BHMeasure.Lux < 20)) {TM1637Brightness = 2;}
    if (TM1637Brightness > 8) {TM1637Brightness = 8;}
    if (TM1637Brightness == 0) {TM1637Brightness = 1;}
    tm1637.setBrightness(TM1637Brightness); // Highest Brightness
    }
   } else
   {
   BHMeasure.DataValid = false;
   BHMeasure.SensorEnabled = false;
   }
return true;
}

void DisplayHumityOnTM1637()
{
byte Humidity = dht.readHumidity();
byte n = (Humidity / 10) % 10; //zehner
byte m = Humidity % 10; // einer
if (Humidity < 100)
 {
 tm1637.display(0,104); // Clear Digit
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 } else
 {
 tm1637.display(0,104); // Clear Digit
 tm1637.display(1,103); // - Sign
 tm1637.display(2,103); // - Sign
 }
tm1637.display(3,56);
```

```
}

void DisplayTempOnLedTM1637()
{
int Temperature = dht.readTemperature(false);   // Read temperature as Celsius (isFahrenheit =
true)
byte n = (Temperature / 10) % 10; //zehner
byte m = Temperature % 10; // einer
if (Temperature < 0)
 {
 tm1637.display(0,103); // - Sign
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 } else if (Temperature < 99)
 {
 tm1637.display(0,104); // Clear Digit
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 } else
 {
 tm1637.display(0,103); // - Sign
 tm1637.display(1,103); // - Sign
 tm1637.display(2,103); // - Sign
 }
tm1637.display(3,99); // C Character
}

void DisplayTempinFOnLedTM1637()
{
int Temperature = dht.readTemperature(true);   // Read temperature as Celsius (Fahrenheit = true)

byte l = (Temperature / 100) % 10; //hunderter
byte n = (Temperature / 10) % 10; //zehner
byte m = Temperature % 10; // einer
if (Temperature < 0)
 {
 tm1637.display(0,103); // - Sign
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 } else if (Temperature < 99)
 {
 tm1637.display(0,104); // Clear Digit
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 } else
 {
 tm1637.display(0,l); // Digit 0
 tm1637.display(1,n); // Digit 1
 tm1637.display(2,m); // Digit 2
 }
tm1637.display(3,102); // F Character
}
```

```
void DisplayClockOnLedTM1637()
{
  if (!(DisableSecondDisplay)) {tm1637.switchColon();}
  tm1637.dispNumber(Minutes24 + Hours24 * 100);
}

byte decToBcd(byte val)
{
  return( (val/10*16) + (val%10) );
}
// Convert binary coded decimal to normal decimal numbers
byte bcdToDec(byte val)
{
  return( (val/16*10) + (val%16) );
}

void setDS3231time(byte second, byte minute, byte hour, byte dayOfWeek, byte
dayOfMonth, byte month, byte year)
{
  // sets time and date data to DS3231
  Wire.beginTransmission(DS3231_I2C_ADDRESS);
  Wire.write(0); // set next input to start at the seconds register
  delay(10);
  Wire.write(decToBcd(second)); // set seconds
  delay(10);
  Wire.write(decToBcd(minute)); // set minutes
  delay(10);
  Wire.write(decToBcd(hour)); // set hours
  delay(10);
  Wire.write(decToBcd(dayOfWeek)); // set day of week (1=Sunday, 7=Saturday)
  delay(10);
  Wire.write(decToBcd(dayOfMonth)); // set date (1 to 31)
  delay(10);
  Wire.write(decToBcd(month)); // set month
  delay(10);
  Wire.write(decToBcd(year)); // set year (0 to 99)
  delay(10);
  Wire.endTransmission();
}

void readDS3231time(byte *second,byte *minute,byte *hour)
{
  byte dummy;
  Wire.beginTransmission(DS3231_I2C_ADDRESS);
  Wire.write(0); // set DS3231 register pointer to 00h
  Wire.endTransmission();
  Wire.requestFrom(DS3231_I2C_ADDRESS, 7);
  //request seven bytes of data from DS3231 starting from register 00h
  while(Wire.available())    // slave may send less than requested
    {
    *second = bcdToDec(Wire.read() & 0x7f);
    *minute = bcdToDec(Wire.read());
    *hour = bcdToDec(Wire.read() & 0x3f);
```

```
   dummy = bcdToDec(Wire.read());
   dummy = bcdToDec(Wire.read());
   dummy = bcdToDec(Wire.read());
   dummy = bcdToDec(Wire.read());
   }
}

void ScheduledTasks ()
{
  if ((Hours24 == 6) and (Minutes24 == 00) and (Seconds24== 00) )
  {
   readDS3231time(&Seconds24,&Minutes24,&Hours24);
  }
  if ((Hours24 == 12) and (Minutes24 == 00) and (Seconds24== 00) )
  {
   readDS3231time(&Seconds24,&Minutes24,&Hours24);
  }
  if ((Hours24 == 18) and (Minutes24 == 00) and (Seconds24== 00) )
  {
   readDS3231time(&Seconds24,&Minutes24,&Hours24);
  }
  if ((Hours24 == 0) and (Minutes24 == 00) and (Seconds24== 00) )
  {
   readDS3231time(&Seconds24,&Minutes24,&Hours24);
  }
}


//Serial Command Interpreter Functions ------------------------------

void ClearCBuffer ()
{
 for (byte a= 0; MaxInputBufferSize -1;a++)
  Cbuffer[a] = 0;
}

boolean CheckforserialEvent()
{
  while (Serial.available()) {
    // get the new byte:
    TBuffer = Serial.read();
    if (TBuffer > 9 && TBuffer < 14)
      {
       Cbuffer[Ccount] = 0;
       TBuffer =0;
       Serial.print(char(13));
       Serial.flush();
       Serial.println("");
       Sbuffer = "";
       value = 0;
       EnterInput = true;
      return true;
    } else if (TBuffer > 47 && TBuffer <58 )
```

```
    {
     if ( Ccount < MaxInputBufferSize)
       {
         Cbuffer[Ccount] = TBuffer;
         Ccount++;
       } else {Serial.print("#"); }
    //Number Input detected
    NumberInput = true;
    }
    else if (TBuffer > 64 && TBuffer < 123 )
    {
     if ( Ccount < MaxInputBufferSize)
       {
         Cbuffer[Ccount] = TBuffer;
         Ccount++;
         Serial.print(char(TBuffer));
         Serial.flush();
       }
    //Character Char Input detected
    StrInput = true;
   }
  else if ( (TBuffer == 127 )  |  (TBuffer == 8 ) )
    {
      if ( Ccount > 0)
       {
         Ccount--;
         Cbuffer[Ccount] = 0;
         Serial.print("-");
         Serial.flush();
       }
    }
  else
     {
      if ( Ccount < MaxInputBufferSize)
       {
         Cbuffer[Ccount] = TBuffer;
         Ccount++;
         Serial.print(char(TBuffer));
         Serial.flush();
    //Data Input detected
    DataInput = true;
    }
   return false;
   }
 return false;
 }
}

byte SerInputHandler()
{
byte result = 0;
int c;
int d;
```

```
int a;
int b;
result = 0;
if (CheckforserialEvent())
   {
    if ((NumberInput) and not (DataInput)and not (StrInput))     //Numbers only
      {
      Sbuffer = "";
      value = 0;
      StrInput = false;
      NumberInput = false;
      DataInput = false;
      EnterInput = false;
      a = 0;
      b = 0;
      c = 0;
      d = 0;
      Sbuffer = Cbuffer; // Zahl wird AUCH ! in SBUFFER übernommen, falls benötigt.
      if (Ccount == 1) { value  = Cbuffer[0]- 48 ; }
      if (Ccount == 2) {
        a = Cbuffer[0] - 48 ;
        a = a * 10;
        b = Cbuffer[1] - 48 ;
        value = a + b;
        }
      if (Ccount == 3) {
        a = Cbuffer[0] - 48 ;
        a = a * 100;
        b = Cbuffer[1] - 48 ;
        b = b * 10;
        c = Cbuffer[2] - 48 ;
        value = a + b + c;
        }
      if (Ccount == 4) {
        a = Cbuffer[0] - 48 ;
        a = a * 1000;
        b = Cbuffer[1] - 48 ;
        b = b * 100;
        c = Cbuffer[2] - 48 ;
        c = c * 10;
        d = Cbuffer[3] - 48 ;
        value = a + b + c + d;
        }
      if (Ccount >= 5)
        {
         Sbuffer = "";
         value = 0;
         Sbuffer = Cbuffer;
         ClearCBuffer;
         result = 2;
        } else
        {
         ClearCBuffer;
```

```
        Ccount = 0;
        result = 1;                              //Number Returncode
        NumberInput = false;
        StrInput = false;
        DataInput = false;
        EnterInput = false;
        Ccount = 0;
        return result;
        }
     }
    if ((StrInput) and not (DataInput))          //String Input only
     {
     Sbuffer = "";
     Sbuffer = Cbuffer;
     value = 0;
     StrInput = false;
     NumberInput = false;
     DataInput = false;
     EnterInput = false;
     Ccount = 0;
     ClearCBuffer;
     result = 2;                                 //Number Returncode
     }
    if (DataInput) {
     Sbuffer = "";
     Sbuffer = Cbuffer;
     value = 0;
     StrInput = false;
     NumberInput = false;
     DataInput = false;
     EnterInput = false;
     Ccount = 0;
     ClearCBuffer;
     result = 3;                                 //Number Returncode
     }
     if ((EnterInput) and not (StrInput) and not (NumberInput) and not (DataInput))
     {
     Sbuffer = "";
     value = 0;
     Ccount = 0;
     ClearCBuffer;
     result = 4;                                 //Number Returncode
     }
  NumberInput = false;
  StrInput = false;
  DataInput = false;
  EnterInput = false;
  Ccount = 0;
  return result;
 }
return result;
  //End CheckforSerialEvent
}
```

```
void SerialcommandProcessor()
{
int a;
Inptype = 0;
Inptype = SerInputHandler();
// 0 keine Rückgabe
// 1 Nummer
// 2 String
// 3 Data
if (Inptype > 0)
  {
  MenueSelection = 0;
  if ((MnuState < 2) && (Inptype == 2)) {Sbuffer.toUpperCase(); } // For Easy Entering Commands
  if ((Sbuffer == "T") && (MnuState == 0) && (Inptype == 2))   { MenueSelection = 1;}
  if ((Sbuffer == "C")&& (MnuState == 0) && (Inptype == 2))      { MenueSelection = 2;}
  if ((Sbuffer == "B") && (MnuState == 0) && (Inptype == 2))      { MenueSelection = 3;}
  if ((Sbuffer == "F") && (MnuState == 0) && (Inptype == 2))      { MenueSelection = 4;}
  if ((MnuState == 2)  && (Inptype == 1))                    { MenueSelection = 8;}
  if (MnuState == 3)                                  { MenueSelection = 9;}
  if (MnuState == 4)                                  { MenueSelection = 10;}
  //Display  Selected Content
  if (MnuState == 9)                                  { MenueSelection = 20;} // Color Set
  if (MnuState == 10)                                  { MenueSelection = 21;} // Time Set
  if (MnuState == 11)                                  { MenueSelection = 24;} // Time Set
  if (MnuState == 12)                                  { MenueSelection = 25;} // Time Set
  if (MnuState == 13)                                  { MenueSelection = 27;} // Background Set
  if (MnuState == 14)                                  { MenueSelection = 29;} // ClockFace Set
  switch (MenueSelection)
   {
     case 1:
     {
     Serial.println("System Time: " + String (Hours24) + ":"+ String (Minutes24) + ":"+ String
(Seconds24) );
     Serial.println("Hour: (0-23)");
     MnuState = 12;
     value = 0;
     Sbuffer = "";
     break;
     }
     case 20:
     {
     value = 0;
     MnuState = 0;
     Sbuffer = "";
     break;
     }
     case 21:
     {
     if ((value >= 0) & (value < 60))
     {
     Seconds24 = value;
     A60telSeconds24 = 0;
```

```
      Serial.println("Seconds " + String (value) + " set.");
      Serial.println("Updated new Time: " + String (Hours24) + ":"+ String (Minutes24) + ":"+ String
(Seconds24) );
      MnuState = 0;
      setDS3231time( Seconds24,Minutes24,Hours24,1,24,6,77);
      delay(100);
      } else
      {
      readDS3231time(&Seconds24,&Minutes24,&Hours24);
      value = 0;
      Sbuffer = "";
      MnuState = 0;
      Serial.println("Value out of Range.");
      }
      value = 0;
      MnuState = 0;
      Sbuffer = "";
      break;
      }
      case 24:
      {
       if ((value >= 0) & (value < 60))
      {
      Minutes24 = value;
      Serial.println("Minutes " + String (value) + " set.");
      MnuState = 10;
      Serial.println("Seconds: (0-60)");
      } else
      {
      readDS3231time(&Seconds24,&Minutes24,&Hours24);
      value = 0;
      Sbuffer = "";
      Serial.println("Value out of Range.");
      MnuState = 0;
      }
      value = 0;
      Sbuffer = "";
      break;
      }
       case 25:
      {
       if ((value >= 0) & (value < 24))
      {
      Hours24 = value;
      Serial.println("Hour " + String (value) + " set.");
      MnuState = 11;
      Serial.println("Minute: (1-60)");
      } else
      {
      readDS3231time(&Seconds24,&Minutes24,&Hours24);
      value = 0;
      Sbuffer = "";
      Serial.println("Value out of Range.");
```

```
      }
      value = 0;
      Sbuffer = "";
      break;
      }
      default:
      {
       Serial.println("-Smart LED Clock  by T.Kuch 2019-");
       Serial.println("T - Set Time");
       Serial.println("Type Cmd and press Enter");
       Serial.flush();
       MnuState = 0;
       value = 0;
       Sbuffer = "";
      }
    }
   } // Eingabe erkannt
}

void loop()
{
  bool PressedC;
  if ((A60telSecInterruptOccured) && (!(SecInterruptOccured)) )
    {
      A60telSecInterruptOccured = false;
     if (BHMeasure.SensorEnabled)
       {
    //   Run_BH1750Sensor(false);
       }
    }
  if (SecInterruptOccured)
    {
       SecInterruptOccured = false;

      // if (DisableSecondDisplay) {Displayalternation = 25;}
       if ((Displayalternation < 7) & (!DisableSecondDisplay))
        {
        DisplayTempOnLedTM1637();
        } else if ((Displayalternation < 14)  & (!DisableSecondDisplay))
        {
        DisplayTempinFOnLedTM1637();
        } else if ((Displayalternation < 21) & (!DisableSecondDisplay))
        {
        DisplayHumityOnTM1637();
        } else if ((Displayalternation < 35) | (DisableSecondDisplay))
        {
        DisplayClockOnLedTM1637();
        } else
        {
         Displayalternation = 0;
        }

       if (!DisableSecondDisplay)
```

```
        {
          if (BHMeasure.SensorEnabled) { Run_BH1750Sensor(false); };
          Run_BH1750Sensor(false);
          Displayalternation ++;
          ScheduledTasks();
        }
     }
   CheckConfigButtons();
   SerialcommandProcessor();
}
```

Ich wünsche viel Spaß beim Nachbau.