Урок 8. Курсовая работа. Настольная метеостанция

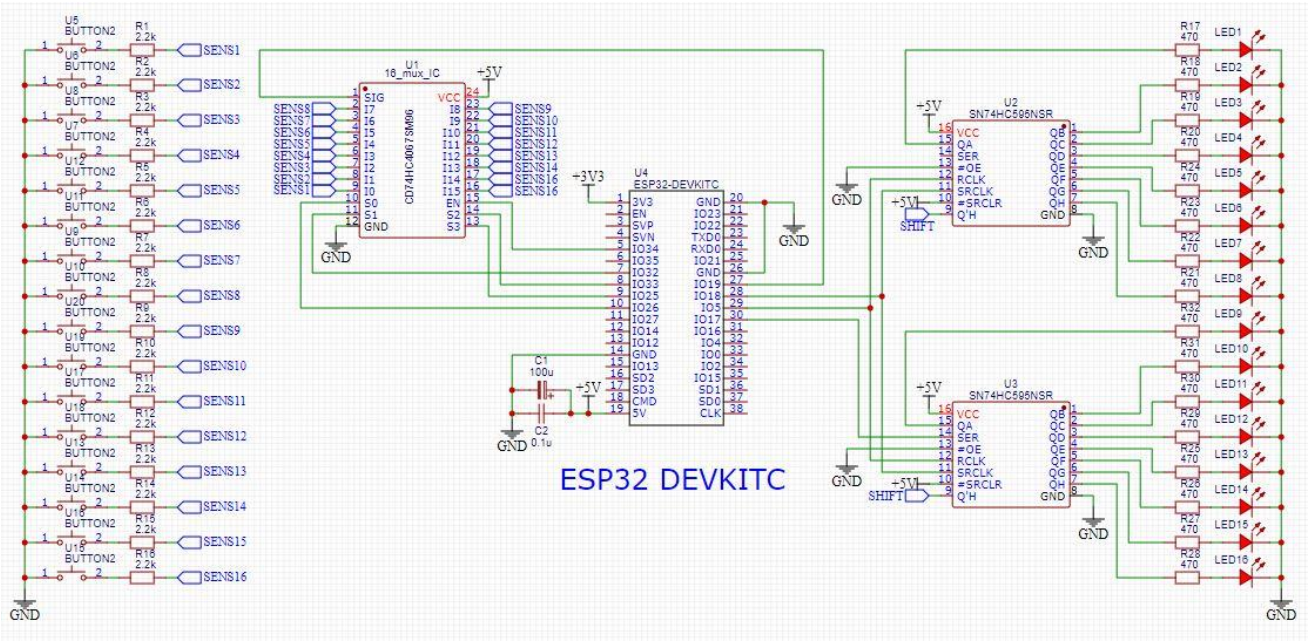
Задание 1. Исходя из имеющихся комплектующих, необходимо создать метеостанцию(или какую-либо станцию, исходя из имеющихся датчиков). Вывод значений должен активно индицироваться, либо выводиться на дисплей. Питание должно быть независимым(при возможности). Плата должна иметь функцию энергосбережения.

Задание 2 (для тех, кто хочет посложнее).* Исходя из имеющихся комплектующих создать метеостанцию, с управлением энкодером и двухуровневым меню. При желании можно добавить игру. Остальные требования соответствуют ДЗ без звездочки.

Задание 1:

В качестве курсовой работы была выбрана станция на ESP32 для подключения датчиков сигнализации. Станция должна иметь возможность подключения 16 датчиков через демультиплексор HP4067 и индикацию 16 светодиодами, подключёнными через сдвиговые регистры SN74HC595NSR, а также WEB-интерфейс для контроля и управления станцией в браузере.

Схема устройства:



WEB-интерфейс представлен ниже:

Код программы:

```
#include <WiFi.h>
#include <WebServer.h>

#define S0_2 26
#define S1_2 32
#define S2_2 33
#define S3_2 25
#define EN_2 34
#define SIG_2 19
const int SER = 16;
const int LATCH = 5;
const int CLK = 18;
int LedOut1 = 0, LedOut2 = 0;
bool leds[16];
bool s0, s1, s2, s3;
int Pins[16];
/* Установите здесь свои SSID и пароль */
const char* ssid = "RT-GPON-27D0";
const char* password = "D3bh3hdjig";
WebServer server(80);
bool flag1 = LOW, flag2 = LOW, flag3 = LOW, flag4 = LOW, flag5 = LOW, flag6 =
LOW, flag7 = LOW, flag8 = LOW, flag9 = LOW, flag10 = LOW, flag11 = LOW, flag12 =
LOW, flag13 = LOW, flag14 = LOW, flag15 = LOW, flag16 = LOW;
bool alarm1 = LOW, alarm2 = LOW, alarm3 = LOW, alarm4 = LOW, alarm5 = LOW, alarm6
= LOW, alarm7 = LOW, alarm8 = LOW, alarm9 = LOW, alarm10 = LOW, alarm11 = LOW,
alarm12 = LOW, alarm13 = LOW, alarm14 = LOW, alarm15 = LOW, alarm16 = LOW;
bool LED1status = LOW;
bool LED2status = LOW;
bool SENSOR3status = LOW;

void setup() {
  Serial.begin(115200);
  delay(100);
  Serial.println("Connecting to ");
  Serial.println(ssid);
  //connect to your local wi-fi network
  WiFi.begin(ssid, password);
  //check wi-fi is connected to wi-fi network
  while (WiFi.status() != WL_CONNECTED) {
  delay(1000);
  Serial.print(".");
  Serial.println(WiFi.status());
  //Serial.println(WiFi.begin(ssid, keyIndex, key));
  pinMode(SER, OUTPUT);
  pinMode(LATCH, OUTPUT);
  pinMode(CLK, OUTPUT);
```

```
pinMode(EN_2, OUTPUT);
pinMode(S0_2, OUTPUT);
pinMode(S1_2, OUTPUT);
pinMode(S2_2, OUTPUT);
pinMode(S3_2, OUTPUT);
pinMode(SIG_2, INPUT_PULLUP);
}
Serial.println("");
Serial.println("WiFi connected..!");
Serial.print("Got IP: ");  Serial.println(WiFi.localIP());
server.on("/", handle_OnConnect);
server.on("/reset", handle_reset);
server.on("/set", handle_set);
server.on("/sensor1off", handle_sensor1off);
server.on("/sensor1check", handle_sensor1check);
server.on("/sensor1alarm", handle_sensor1alarm);
server.on("/sensor2off", handle_sensor2off);
server.on("/sensor2check", handle_sensor2check);
server.on("/sensor2alarm", handle_sensor2alarm);
server.on("/sensor3off", handle_sensor3off);
server.on("/sensor3check", handle_sensor3check);
server.on("/sensor3alarm", handle_sensor3alarm);
server.on("/sensor4off", handle_sensor4off);
server.on("/sensor4check", handle_sensor4check);
server.on("/sensor4alarm", handle_sensor4alarm);
server.on("/sensor5off", handle_sensor5off);
server.on("/sensor5check", handle_sensor5check);
server.on("/sensor5alarm", handle_sensor5alarm);
server.on("/sensor6off", handle_sensor6off);
server.on("/sensor6check", handle_sensor6check);
server.on("/sensor6alarm", handle_sensor6alarm);
server.on("/sensor7off", handle_sensor7off);
server.on("/sensor7check", handle_sensor7check);
server.on("/sensor7alarm", handle_sensor7alarm);
server.on("/sensor8off", handle_sensor8off);
server.on("/sensor8check", handle_sensor8check);
server.on("/sensor8alarm", handle_sensor8alarm);
server.on("/sensor9off", handle_sensor9off);
server.on("/sensor9check", handle_sensor9check);
server.on("/sensor9alarm", handle_sensor9alarm);
server.on("/sensor10off", handle_sensor10off);
server.on("/sensor10check", handle_sensor10check);
server.on("/sensor10alarm", handle_sensor10alarm);
server.on("/sensor11off", handle_sensor11off);
server.on("/sensor11check", handle_sensor11check);
server.on("/sensor11alarm", handle_sensor11alarm);
server.on("/sensor12off", handle_sensor12off);
server.on("/sensor12check", handle_sensor12check);
server.on("/sensor12alarm", handle_sensor12alarm);
server.on("/sensor13off", handle_sensor13off);
server.on("/sensor13check", handle_sensor13check);
```

```
  server.on("/sensor13alarm", handle_sensor13alarm);
  server.on("/sensor14off", handle_sensor14off);
  server.on("/sensor14check", handle_sensor14check);
  server.on("/sensor14alarm", handle_sensor14alarm);
  server.on("/sensor15off", handle_sensor15off);
  server.on("/sensor15check", handle_sensor15check);
  server.on("/sensor15alarm", handle_sensor15alarm);
  server.on("/sensor16off", handle_sensor16off);
  server.on("/sensor16check", handle_sensor16check);
  server.on("/sensor16alarm", handle_sensor16alarm);
  server.onNotFound(handle_NotFound);
  server.begin();
  Serial.println("HTTP server started");
}

void Shift16Leds()
{
int reg[8] = {128,64,32,16,8,4,2,1};
for (int i = 0; i<=7;i++)
{
LedOut1 = LedOut1 + (leds[i]*reg[i]);
}
for (int i = 8; i<=15;i++)
{
LedOut2 = LedOut2 + (leds[i]*reg[i-8]);
}
    digitalWrite(LATCH, LOW);
    shiftOut(SER, CLK, MSBFIRST, LedOut1);
    shiftOut(SER, CLK, MSBFIRST, LedOut2);
    digitalWrite(LATCH, HIGH);
  //  delay(1000);
    LedOut1 = 0;
    LedOut2 = 0;
}
void MUXin()
{
  for (int i=0; i<=15; i++)
  {
  s0 = i%2;
  s1 = i/2%2;
  s2 = i/4%2;
  s3 = i/8%2;
  digitalWrite(EN_2, HIGH);
  digitalWrite(S0_2, s0);
  digitalWrite(S1_2, s1);
  digitalWrite(S2_2, s2);
  digitalWrite(S3_2, s3);
  digitalWrite(EN_2, LOW);
  delay(5);
  Pins[i] = (1-digitalRead(SIG_2))*(i+1);
  leds[i] = 1-digitalRead(SIG_2);
```

```
  }
}

void loop() {
  MUXin();
  Shift16Leds();
  if((1-leds[0])==0 && flag1 == 0)
  {flag1 = 1;}
  if((1-leds[1])==0 && flag2 == 0)
  {flag2 = 1;}
  if((1-leds[2])==0 && flag3 == 0)
  {flag3 = 1;}
  if((1-leds[3])==0 && flag4 == 0)
  {flag4 = 1;}
  if((1-leds[4])==0 && flag5 == 0)
  {flag5 = 1;}
  if((1-leds[5])==0 && flag6 == 0)
  {flag6 = 1;}
  if((1-leds[6])==0 && flag7 == 0)
  {flag7 = 1;}
  if((1-leds[7])==0 && flag8 == 0)
  {flag8 = 1;}
  if((1-leds[8])==0 && flag9 == 0)
  {flag9 = 1;}
  if((1-leds[9])==0 && flag10 == 0)
  {flag10 = 1;}
  if((1-leds[10])==0 && flag11 == 0)
  {flag11 = 1;}
  if((1-leds[11])==0 && flag12 == 0)
  {flag12 = 1;}
  if((1-leds[12])==0 && flag13 == 0)
  {flag13 = 1;}
  if((1-leds[13])==0 && flag14 == 0)
  {flag14 = 1;}
  if((1-leds[14])==0 && flag15 == 0)
  {flag15 = 1;}
  if((1-leds[15])==0 && flag16 == 0)
  {flag16 = 1;}
  server.handleClient();
}
void handle_OnConnect() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,SENSOR3status));
}
void handle_reset() {
  flag1 = 0;
  alarm1 = 0;
  flag2 = 0;
  alarm2 = 0;
  flag3 = 0;
  alarm3 = 0;
  flag4 = 0;
```

```
  alarm4 = 0;
  flag5 = 0;
  alarm5 = 0;
  flag6 = 0;
  alarm6 = 0;
  flag7 = 0;
  alarm7 = 0;
  flag8 = 0;
  alarm8 = 0;
  flag9 = 0;
  alarm9 = 0;
  flag10 = 0;
  alarm10 = 0;
  flag11 = 0;
  alarm11 = 0;
  flag12 = 0;
  alarm12 = 0;
  flag13 = 0;
  alarm13 = 0;
  flag14 = 0;
  alarm14 = 0;
  flag15 = 0;
  alarm15 = 0;
  flag16 = 0;
  alarm16 = 0;
  server.send(200, "text/html", SendHTML(true,LED2status,SENSOR3status));
}
void handle_set() {
  LED1status = LOW;
  server.send(200, "text/html", SendHTML(false,LED2status,SENSOR3status));
}

void handle_sensor1off() {
  SENSOR3status = HIGH;
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor1check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor1alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor2off() {
  SENSOR3status = HIGH;
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor2check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor2alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
```

```
}
void handle_sensor3off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor3check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor3alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor4off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor4check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor4alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor5off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor5check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor5alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor6off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor6check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor6alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor7off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor7check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor7alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor8off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor8check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
```

```
}
void handle_sensor8alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor9off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor9check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor9alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor10off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor10check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor10alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor11off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor11check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor11alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor12off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor12check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor12alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor13off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor13check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor13alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor14off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
```

```
}
void handle_sensor14check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor14alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor15off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor15check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor15alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_sensor16off() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,1));
}
void handle_sensor16check() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,2));
}
void handle_sensor16alarm() {
  server.send(200, "text/html", SendHTML(LED1status,LED2status,3));
}
void handle_NotFound(){
  server.send(404, "text/plain", "Not found");
}
String SendHTML(uint8_t led1stat, uint8_t led2stat, uint8_t sensor3stat){
  String ptr = "<!DOCTYPE html> <html>\n";
  ptr +="<meta http-equiv=\"Content-type\" content=\"text/html; charset=utf-
8\"><head><meta name=\"viewport\" content=\"width=device-width, initial-
scale=0.8, user-scalable=no\">\n";
  ptr +="<meta http-equiv=\"Refresh\" content=\"1\" />\n";
  ptr +="<title>Сигнализация</title>\n";
  ptr +="<style>html { font-family: Helvetica; display: inline-block; margin: 0px
auto; text-align: center;}\n";
  ptr +="body{margin-top: 10px;} h1 {color: #444444;margin: 10px auto 10px;}\n";
//h3 {color: #444444;margin-bottom: 50px;}\n";
  ptr +=".button {display: block;width: 200px;background-color: #7CEC00;border:
none;color: white;padding: 5px 30px;text-decoration: none;font-size: 25px;margin:
0px auto 0px;cursor: pointer;border-radius: 4px;}\n";
  ptr +=".button-on {background-color: #9D2EFE;}\n";
  ptr +=".button-check:on {background-color: #9D2EFE;}\n";
  ptr +=".button-check {background-color: #7CEC00;}\n";
  ptr +=".button-check:active {background-color: #7CEC00;}\n";
  ptr +=".button-alarm {background-color: #ff0000;}\n";
  ptr +=".button-alarm:active {background-color: #ff0000;}\n";
  ptr +=".button-off {background-color: #909090;}\n";
  ptr +=".button-off:active {background-color: #909090;}\n";
```

```
  ptr +="p {font-size: 20px;color: #444444;margin-bottom: 1px; margin-top:
3px}\n";
  ptr +="</style>\n";
  ptr +="</head>\n";
  ptr +="<body>\n";
  ptr +="<h1>Сигнализация</h1>\n";
  //  ptr +="<h3>Режим станции (STA)</h3>\n";
   if(led1stat)
  {ptr +="<p>Подключите датчики и нажмите ПЕРЕЗАПУСК</p><a class=\"button button-
off\" href=\"/set\">ПЕРЕЗАПУСК</a>\n";}
  else
  {ptr +="<p>Нажмите СБРОС в случае тревоги</p><a class=\"button button-on\"
href=\"/reset\">СБРОС</a>\n";}

  if(((1-leds[0]) && flag1) || alarm1 == 1)
  {ptr +="<p>Датчик №1</p><a class=\"button button-alarm\"
href=\"/sensor1alarm\">ТРЕВОГА!</a>\n";
  alarm1 = 1;}
  else if ((1-leds[0])==0)
  {ptr +="<p>Датчик №1</p><a class=\"button button-check\"
href=\"/sensor1check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №1</p><a class=\"button button-off\"
href=\"/sensor1off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[1]) && flag2) || alarm2 == 1)
  {ptr +="<p>Датчик №2</p><a class=\"button button-alarm\"
href=\"/sensor2alarm\">ТРЕВОГА!</a>\n";
  alarm2 = 1;}
  else if ((1-leds[1])==0)
  {ptr +="<p>Датчик №2</p><a class=\"button button-check\"
href=\"/sensor2check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №2</p><a class=\"button button-off\"
href=\"/sensor2off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[2]) && flag3) || alarm3 == 1)
  {ptr +="<p>Датчик №3</p><a class=\"button button-alarm\"
href=\"/sensor3alarm\">ТРЕВОГА!</a>\n";
  alarm3 = 1;}
  else if ((1-leds[2])==0)
  {ptr +="<p>Датчик №3</p><a class=\"button button-check\"
href=\"/sensor3check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №3</p><a class=\"button button-off\"
href=\"/sensor3off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[3]) && flag4) || alarm4 == 1)
  {ptr +="<p>Датчик №4</p><a class=\"button button-alarm\"
href=\"/sensor4alarm\">ТРЕВОГА!</a>\n";
  alarm4 = 1;}
```

```
  else if ((1-leds[3])==0)
  {ptr +="<p>Датчик №4</p><a class=\"button button-check\"
href=\"/sensor4check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №4</p><a class=\"button button-off\"
href=\"/sensor4off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[4]) && flag5) || alarm5 == 1)
  {ptr +="<p>Датчик №5</p><a class=\"button button-alarm\"
href=\"/sensor5alarm\">ТРЕВОГА!</a>\n";
  alarm5 = 1;}
  else if ((1-leds[4])==0)
  {ptr +="<p>Датчик №5</p><a class=\"button button-check\"
href=\"/sensor5check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №5</p><a class=\"button button-off\"
href=\"/sensor5off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[5]) && flag6) || alarm6 == 1)
  {ptr +="<p>Датчик №6</p><a class=\"button button-alarm\"
href=\"/sensor6alarm\">ТРЕВОГА!</a>\n";
  alarm6 = 1;}
  else if ((1-leds[5])==0)
  {ptr +="<p>Датчик №6</p><a class=\"button button-check\"
href=\"/sensor6check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №6</p><a class=\"button button-off\"
href=\"/sensor6off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[6]) && flag7) || alarm7 == 1)
  {ptr +="<p>Датчик №7</p><a class=\"button button-alarm\"
href=\"/sensor7alarm\">ТРЕВОГА!</a>\n";
  alarm7 = 1;}
  else if ((1-leds[6])==0)
  {ptr +="<p>Датчик №7</p><a class=\"button button-check\"
href=\"/sensor7check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №7</p><a class=\"button button-off\"
href=\"/sensor7off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[7]) && flag8) || alarm8 == 1)
  {ptr +="<p>Датчик №8</p><a class=\"button button-alarm\"
href=\"/sensor8alarm\">ТРЕВОГА!</a>\n";
  alarm8 = 1;}
  else if ((1-leds[7])==0)
  {ptr +="<p>Датчик №8</p><a class=\"button button-check\"
href=\"/sensor8check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №8</p><a class=\"button button-off\"
href=\"/sensor8off\">ВЫКЛЮЧЕН</a>\n";}
```

```
  if(((1-leds[8]) && flag9) || alarm9 == 1)
  {ptr +="<p>Датчик №9</p><a class=\"button button-alarm\"
href=\"/sensor9alarm\">ТРЕВОГА!</a>\n";
  alarm9 = 1;}
  else if ((1-leds[8])==0)
  {ptr +="<p>Датчик №9</p><a class=\"button button-check\"
href=\"/sensor9check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №9</p><a class=\"button button-off\"
href=\"/sensor9off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[9]) && flag10) || alarm10 == 1)
  {ptr +="<p>Датчик №10</p><a class=\"button button-alarm\"
href=\"/sensor10alarm\">ТРЕВОГА!</a>\n";
  alarm10 = 1;}
  else if ((1-leds[9])==0)
  {ptr +="<p>Датчик №10</p><a class=\"button button-check\"
href=\"/sensor10check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №10</p><a class=\"button button-off\"
href=\"/sensor10off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[10]) && flag11) || alarm11 == 1)
  {ptr +="<p>Датчик №11</p><a class=\"button button-alarm\"
href=\"/sensor11alarm\">ТРЕВОГА!</a>\n";
  alarm11 = 1;}
  else if ((1-leds[10])==0)
  {ptr +="<p>Датчик №11</p><a class=\"button button-check\"
href=\"/sensor11check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №11</p><a class=\"button button-off\"
href=\"/sensor11off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[11]) && flag12) || alarm12 == 1)
  {ptr +="<p>Датчик №12</p><a class=\"button button-alarm\"
href=\"/sensor12alarm\">ТРЕВОГА!</a>\n";
  alarm12 = 1;}
  else if ((1-leds[11])==0)
  {ptr +="<p>Датчик №12</p><a class=\"button button-check\"
href=\"/sensor12check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №12</p><a class=\"button button-off\"
href=\"/sensor12off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[12]) && flag13) || alarm13 == 1)
  {ptr +="<p>Датчик №13</p><a class=\"button button-alarm\"
href=\"/sensor13alarm\">ТРЕВОГА!</a>\n";
  alarm13 = 1;}
  else if ((1-leds[12])==0)
  {ptr +="<p>Датчик №13</p><a class=\"button button-check\"
href=\"/sensor13check\">ОХРАНА</a>\n";}
```

```
  else
  {ptr +="<p>Датчик №13</p><a class=\"button button-off\"
href=\"/sensor13off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[13]) && flag14) || alarm14 == 1)
  {ptr +="<p>Датчик №14</p><a class=\"button button-alarm\"
href=\"/sensor14alarm\">ТРЕВОГА!</a>\n";
  alarm14 = 1;}
  else if ((1-leds[13])==0)
  {ptr +="<p>Датчик №14</p><a class=\"button button-check\"
href=\"/sensor14check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №14</p><a class=\"button button-off\"
href=\"/sensor14off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[14]) && flag15) || alarm15 == 1)
  {ptr +="<p>Датчик №15</p><a class=\"button button-alarm\"
href=\"/sensor15alarm\">ТРЕВОГА!</a>\n";
  alarm15 = 1;}
  else if ((1-leds[14])==0)
  {ptr +="<p>Датчик №15</p><a class=\"button button-check\"
href=\"/sensor15check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №15</p><a class=\"button button-off\"
href=\"/sensor15off\">ВЫКЛЮЧЕН</a>\n";}

  if(((1-leds[15]) && flag16) || alarm16 == 1)
  {ptr +="<p>Датчик №16</p><a class=\"button button-alarm\"
href=\"/sensor16alarm\">ТРЕВОГА!</a>\n";
  alarm16 = 1;}
  else if ((1-leds[15])==0)
  {ptr +="<p>Датчик №16</p><a class=\"button button-check\"
href=\"/sensor16check\">ОХРАНА</a>\n";}
  else
  {ptr +="<p>Датчик №16</p><a class=\"button button-off\"
href=\"/sensor16off\">ВЫКЛЮЧЕН</a>\n";}

  ptr +="</body>\n";
  ptr +="</html>\n";
  return ptr;
}
```

Работа станции показана на видео: Signal_ESP32.mp4