COMSATS University Islamabad

Lab Report # 13-14

Real Time Embedded Systems (EEE-446)

Control Home Appliances using MIT App and Google Firebase Real-time Database

Submitted By:

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Submitted To:

Dr. Ahsen Malik

Lab # 13 - 14

Control Home Appliances using MIT App and Google Firebase Real-time Database

Objectives

- Connect DH11 Humidity/Temperature Sensor to Local Server
- Use Smart Config to configure anonymous ESP32 with local Wifi
- Real time database creation using Google Firebase
- Connectivity of database with Android App and ESP32 Module
- Control of home appliances using ESP32

Tools

- Arduino
- ESP32 Board
- 2 LEDs
- DHT11 sensor
- Relay board
- 220V AC Light

Task 1

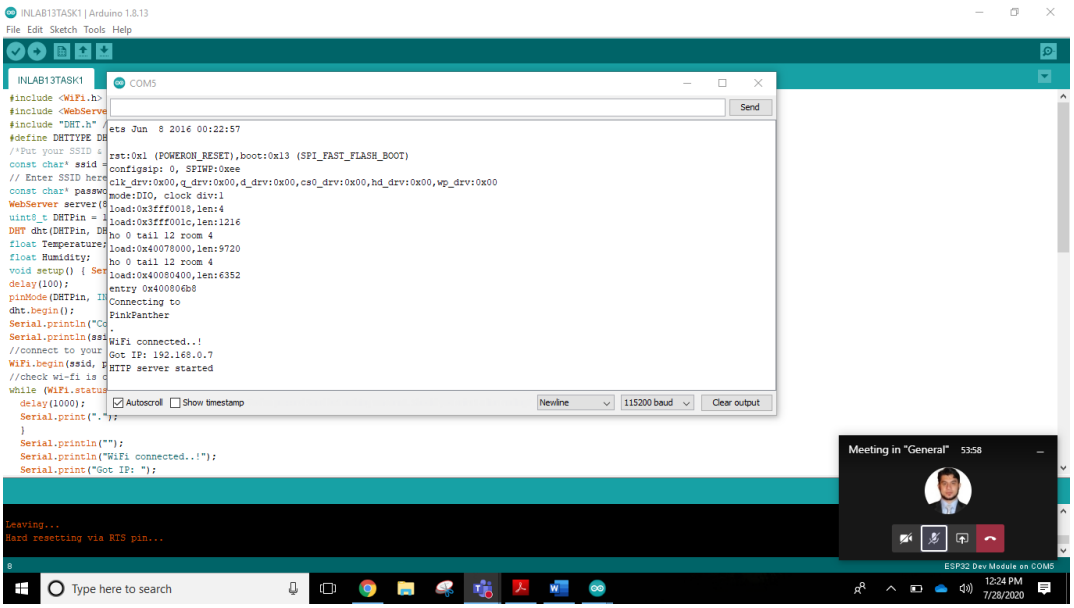
Temperature/Humidity Sensor Read using DHT Sensor:

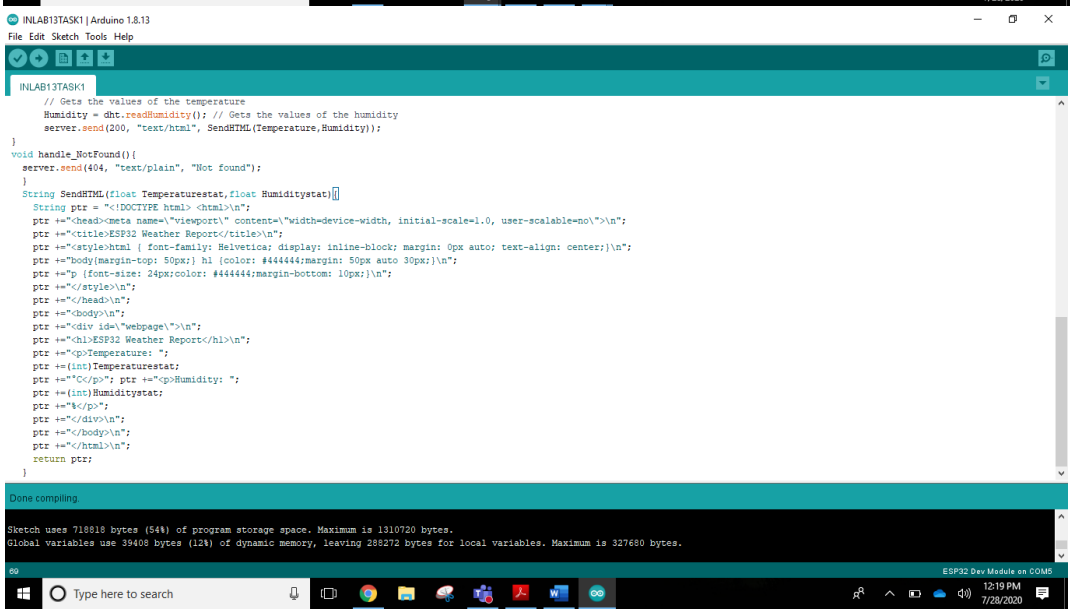
```
#include <WiFi.h>
#include
<WebServer.h>
#include "DHT.h"

// Uncomment one of the lines below for whatever DHT sensor type you're using!
#define DHTTYPE DHT11               // DHT 11
//#define DHTTYPE DHT21               // DHT 21 (AM2301)
//#define DHTTYPE DHT22               // DHT 22 (AM2302), AM2321

/*Put your SSID & Password*/
const char* ssid = "Ahsan"; // Enter SSID here
const char* password = "12345678"; //Enter Password here


WebServer server(80);
```

```
// DHT Sensor
uint8_t DHTPin
= 15;

// Initialize DHT sensor.
DHT dht(DHTPin,
DHTTYPE);

float
Temperature;
float Humidity;

void setup() {
  Serial.begin(115200);
  delay(100);

  pinMode(DHTPin, INPUT);
  dht.begin();

  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("");
  Serial.println("WiFi connected..!");
  Serial.print("Got IP: ");  Serial.println(WiFi.localIP());

  server.on("/", handle_OnConnect);
  server.onNotFound(handle_NotFound);

  server.begin();
  Serial.println("HTTP server started");

}
```

```
void loop() {

  server.handleClient();

}

void handle_OnConnect() {

 Temperature = dht.readTemperature(); // Gets the values of the
temperature
  Humidity = dht.readHumidity(); // Gets the values of the humidity

  server.send(200, "text/html", SendHTML(Temperature,Humidity));
}


void handle_NotFound(){
  server.send(404, "text/plain", "Not found");
}

String SendHTML(float Temperaturestat,float Humiditystat){ String
  ptr = "<!DOCTYPE html> <html>\n";
  ptr +="<head><meta name=\"viewport\" content=\"width=device-width, initial-
scale=1.0, user-scalable=no\">\n";
  ptr +="<title>ESP32 Weather Report</title>\n";
  ptr +="<style>html { font-family: Helvetica; display: inline-block; margin: 0px auto; text-
align: center;}\n";
  ptr +="body{margin-top: 50px;} h1 {color: #444444;margin: 50px auto 30px;}\n";
  ptr +="p {font-size: 24px;color: #444444;margin-bottom: 10px;}\n"; ptr
  +="</style>\n";
  ptr
  +="</head>\n"
  ; ptr
  +="<body>\n";
  ptr +="<div id=\"webpage\">\n";
  ptr +="<h1>ESP32 Weather Report</h1>\n";

  ptr +="<p>Temperature:
  "; ptr
  +=(int)Temperaturestat;
  ptr +="°C</p>";
  ptr +="<p>Humidity:
  "; ptr
```

```
  +=(int)Humiditystat;
  ptr +="%</p>";

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





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File Edit Sketch Tools Help

INLAB13TASK1

```
  Serial.println("WiFi connected..!");
  Serial.print("Got IP: ");
  Serial.println(WiFi.localIP());
  server.on("/", handle_OnConnect);
  server.onNotFound(handle_NotFound);
  server.begin();
  Serial.println("HTTP server started");
  }
  void loop() {
    server.handleClient();
    }
    void handle_OnConnect() {
      Temperature = dht.readTemperature();
      // Gets the values of the temperature
      Humidity = dht.readHumidity(); // Gets the values of the humidity
      server.send(200, "text/html", SendHTML(Temperature,Humidity));
}
void handle_NotFound(){
  server.send(404, "text/plain", "Not found");
  }
  String SendHTML(float Temperaturestat,float Humiditystat){
    String ptr = "<!DOCTYPE html> <html>\n";
    ptr +="<head><meta name=\"viewport\" content=\"width=device-width, initial-scale=1.0, user-scalable=no\">\n";
    ptr +="<title>ESP32 Weather Report</title>\n";
    ptr +="<style>html { font-family: Helvetica; display: inline-block; margin: 0px auto; text-align: center;}\n";
    ptr +="body{margin-top: 50px;} h1 {color: #444444;margin: 50px auto 30px;}\n";
    ptr +="p {font-size: 24px;color: #444444;margin-bottom: 10px;}\n";
    ptr +="</style>\n";
    ptr +="</head>\n";
```

Done compiling.

```
Sketch uses 718818 bytes (54%) of program storage space. Maximum is 1310720 bytes.
Global variables use 39408 bytes (12%) of dynamic memory, leaving 288272 bytes for local variables. Maximum is 327680 bytes.
```

69 ESP32 Dev Module on COM5

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INLAB13TASK1 | Arduino 1.8.13

File Edit Sketch Tools Help

INLAB13TASK1

```
#include <WiFi.h>
#include <WebServer.h>
#include "DHT.h" // Uncomment one of the lines below for whatever DHT sensor type you're using!
#define DHTTYPE DHT11 // DHT 11 //#define DHTTYPE DHT21 // DHT 21 (AM2301) //#define DHTTYPE DHT22 // DHT 22 (AM2302), AM2321
/*Put your SSID & Password*/
const char* ssid = "Ahsan";
// Enter SSID here
const char* password = "12345678"; //Enter Password here
WebServer server(80); // DHT Sensor
uint8_t DHTPin = 15; // Initialize DHT sensor.
DHT dht(DHTPin, DHTTYPE);
float Temperature;
float Humidity;
void setup() { Serial.begin(115200);
delay(100);
pinMode(DHTPin, INPUT);
dht.begin();
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("");
  Serial.println("WiFi connected..!");
  Serial.print("Got IP: ");
```

Done compiling.

69 ESP32 Dev Module on COM5

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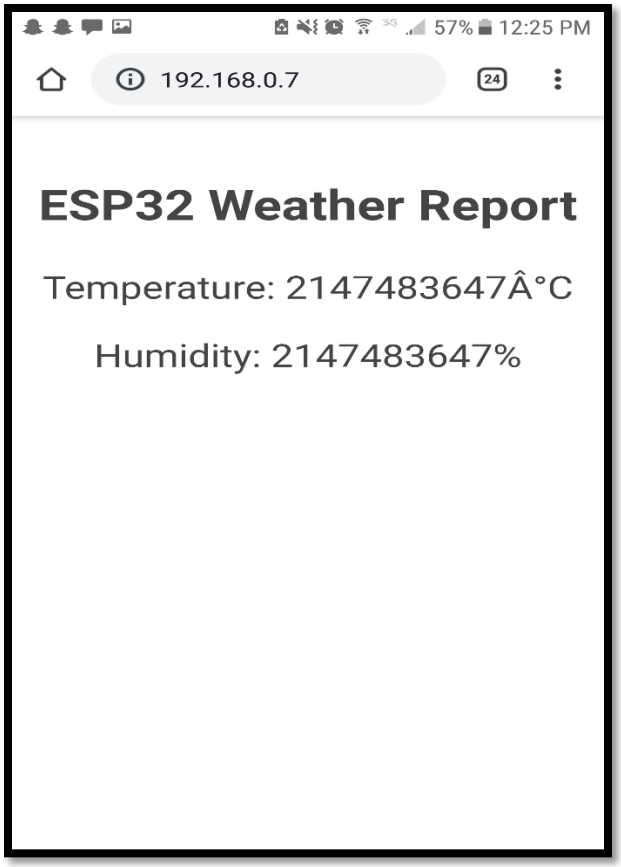


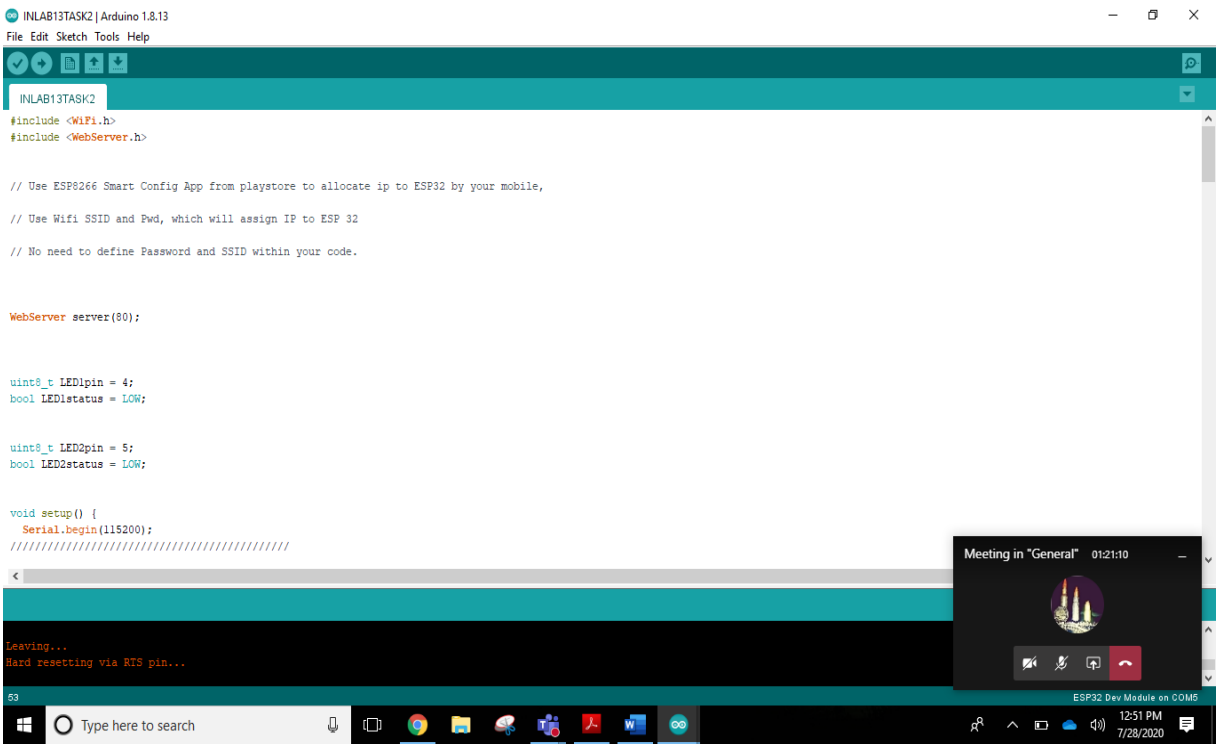
Task 2

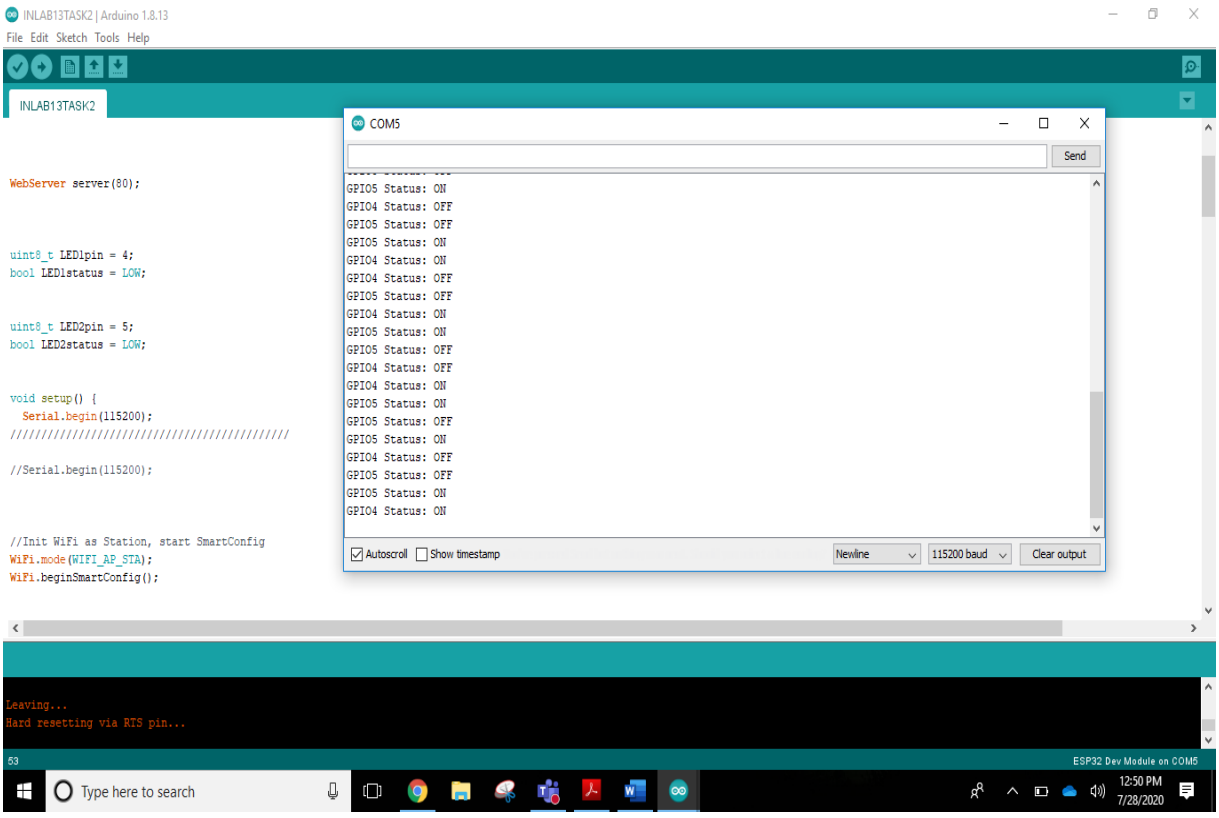
Use ESP8266 Smart Config App from Google Play Store to allocate IP to ESP32 by your mobile at Run-time

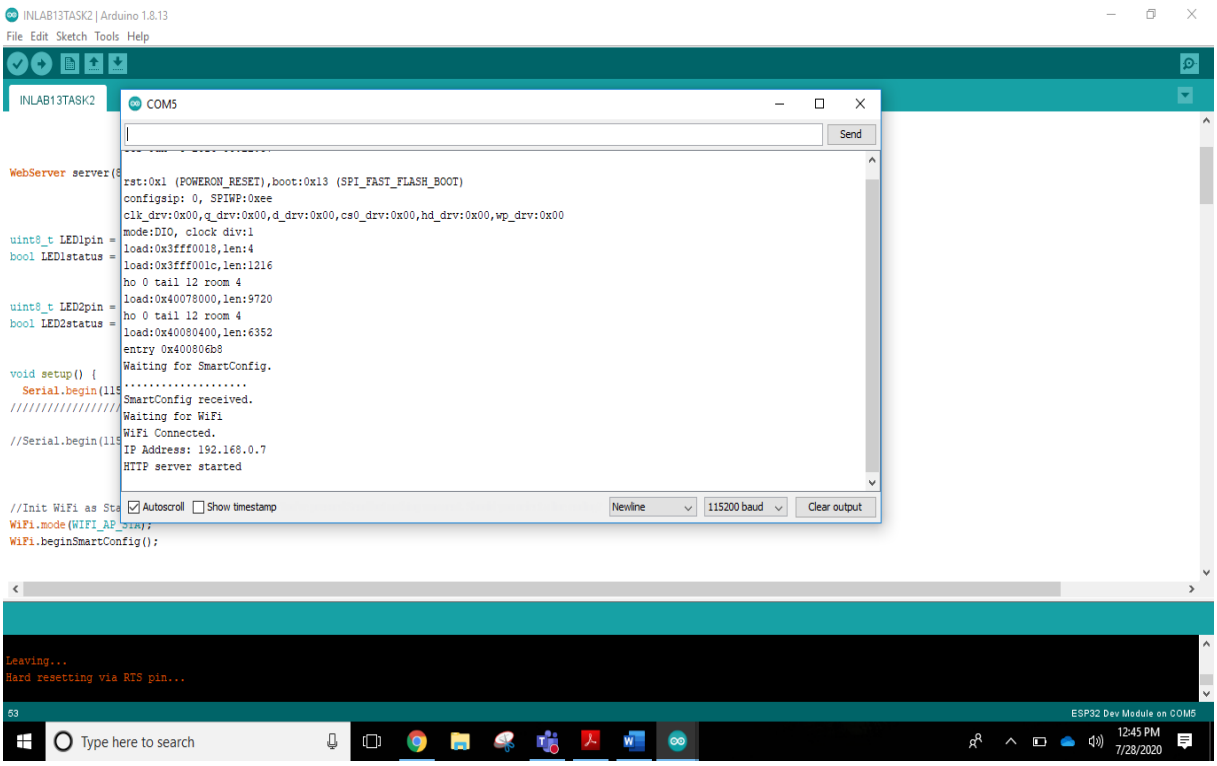
```
#include <WiFi.h>
#include <WebServer.h>
// Use ESP8266 Smart Config App from playstore to allocate ip to ESP32 by your mobile,
// Use Wifi SSID and Pwd, which will assign IP to ESP 32
// No need to define Password and SSID within your code.
WebServer server(80);
uint8_t LED1pin = 4;
bool LED1status = LOW;
uint8_t LED2pin = 5;
bool LED2status = LOW;
void setup() {
  Serial.begin(115200);
////////////////////////////////////////////
//Serial.begin(115200);
//Init WiFi as Station, start SmartConfig
WiFi.mode(WIFI_AP_STA);
WiFi.beginSmartConfig()
```

```
//Wait for SmartConfig packet from mobile
Serial.println("Waiting for SmartConfig.");
while (!WiFi.smartConfigDone()) {
  delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("SmartConfig received.");
//Wait for WiFi to connect to AP
Serial.println("Waiting for WiFi");
while (WiFi.status() != WL_CONNECTED)
{ delay(500);
Serial.print(".");
}
Serial.println("WiFi Connected.");
Serial.print("IP Address: ");
Serial.println(WiFi.localIP());
////////////////////////////////////////////////
pinMode(LED1pin, OUTPUT); pinMode(LED2pin, OUTPUT);
//WiFi.softAP(ssid, password);
//WiFi.softAPConfig(local_ip, gateway, subnet);
delay(100);
server.on("/", handle_OnConnect);
server.on("/led1on", handle_led1on);
server.on("/led1off", handle_led1off);
server.on("/led2on", handle_led2on);
server.on("/led2off", handle_led2off);
server.onNotFound(handle_NotFound);
server.begin();
Serial.println("HTTP server started");
}
void loop() { server.handleClient(); if(LED1status)
{digitalWrite(LED1pin, HIGH);}
else
{digitalWrite(LED1pin, LOW);}
if(LED2status)
{digitalWrite(LED2pin, HIGH);}
else
{digitalWrite(LED2pin, LOW);}
}
void handle_OnConnect() {
  LED1status = LOW;
  LED2status = LOW;
Serial.println("GPIO4 Status: OFF | GPIO5 Status: OFF");
server.send(200, "text/html", SendHTML(LED1status,LED2status));
}
void handle_led1on() {
  LED1status = HIGH;
```

```
Serial.println("GPIO4 Status: ON");
server.send(200, "text/html", SendHTML(true,LED2status));
}
void handle_led1off() {
  LED1status = LOW;
Serial.println("GPIO4 Status: OFF");
server.send(200, "text/html", SendHTML(false,LED2status));
}
void handle_led2on() { LED2status = HIGH;
Serial.println("GPIO5 Status: ON");
server.send(200, "text/html", SendHTML(LED1status,true));
}
void handle_led2off() {
  LED2status = LOW;
Serial.println("GPIO5 Status: OFF");
server.send(200, "text/html", SendHTML(LED1status,false));
}
void handle_NotFound(){
server.send(404, "text/plain", "Not found");
}
String SendHTML(uint8_t led1stat,uint8_t led2stat){ String ptr = "<!DOCTYPE html> <html>\n";
ptr +="<head><meta name=\"viewport\" content=\"width=device-width, initial-scale=1.0, user-
scalable=no\">\n";
ptr +="<title>LED Control</title>\n";
ptr +="<style>html { font-family: Helvetica; display: inline-block; margin: 0px auto; text-align: center;}\n";
ptr +="body{margin-top: 50px;} h1 {color: #444444;margin: 50px auto 30px;} h3 {color: #444444;margin-
bottom: 50px;}\n";
ptr +=".button {display: block;width: 80px;background-color: #3498db;border: none;color: white;padding: 13px
30px;text-decoration: none;font-size: 25px;margin: 0px auto 35px;cursor: pointer;border-radius: 4px;}\n";
ptr +=".button-on {background-color: #3498db;}\n";
ptr +=".button-on:active {background-color: #2980b9;}\n"; ptr +=".button-off {background-color: #34495e;}\n";
ptr +=".button-off:active {background-color: #2c3e50;}\n";
ptr +="p {font-size: 14px;color: #888;margin-bottom: 10px;}\n"; ptr +="</style>\n";
ptr +="</head>\n"; ptr +="<body>\n";
ptr +="<h1>ESP32 Web Server</h1>\n";
ptr +="<h3>Using Access Point(AP) Mode</h3>\n";
if(led1stat)
{ptr +="<p>LED1 Status: ON</p><a class=\"button button-off\" href=\"/led1off\">OFF</a>\n";} else
{ptr +="<p>LED1 Status: OFF</p><a class=\"button button-on\" href=\"/led1on\">ON</a>\n";}
if(led2stat)
{ptr +="<p>LED2 Status: ON</p><a class=\"button button-off\" href=\"/led2off\">OFF</a>\n";} else
{ptr +="<p>LED2 Status: OFF</p><a class=\"button button-on\" href=\"/led2on\">ON</a>\n";}
ptr +="</body>\n"; ptr +="</html>\n"; return ptr;
}
```


INLAB13TASK2 | Arduino 1.8.13
File Edit Sketch Tools Help
INLAB13TASK2
#include <WiFi.h>
#include <WebServer.h>
// Use ESP8266 Smart Config App from playstore to allocate ip to ESP32 by your mobile,
// Use Wifi SSID and Pwd, which will assign IP to ESP 32
// No need to define Password and SSID within your code.
WebServer server(80);
uint8_t LED1pin = 4;
bool LED1status = LOW;
uint8_t LED2pin = 5;
bool LED2status = LOW;
void setup() {
Serial.begin(115200);
Meeting in "General" 01:21:10
Leaving...
Hard resetting via RTS pin...
53
ESP32 Dev Module on COM5
Type here to search
12:51 PM
7/28/2020


INLAB13TASK2 | Arduino 1.8.13
File Edit Sketch Tools Help
INLAB13TASK2
COM5
Send
GPIO5 Status: ON
GPIO4 Status: OFF
GPIO5 Status: OFF
GPIO5 Status: ON
GPIO4 Status: ON
GPIO4 Status: OFF
GPIO5 Status: OFF
GPIO4 Status: ON
GPIO5 Status: ON
GPIO5 Status: OFF
GPIO4 Status: OFF
GPIO4 Status: ON
GPIO5 Status: ON
GPIO5 Status: OFF
GPIO5 Status: ON
GPIO4 Status: OFF
GPIO5 Status: OFF
GPIO5 Status: ON
GPIO4 Status: ON
Autoscroll
Show timestamp
Newline
115200 baud
Clear output
WebServer server(80);
uint8_t LED1pin = 4;
bool LED1status = LOW;
uint8_t LED2pin = 5;
bool LED2status = LOW;
void setup() {
Serial.begin(115200);
//Serial.begin(115200);
//Init WiFi as Station, start SmartConfig
WiFi.mode(WIFI_AP_STA);
WiFi.beginSmartConfig();
Leaving...
Hard resetting via RTS pin...
53
ESP32 Dev Module on COM5
Type here to search
12:50 PM
7/28/2020


INLAB13TASK2 | Arduino 1.8.13
File Edit Sketch Tools Help
INLAB13TASK2
COM5
Send
rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0018,len:4
load:0x3fff001c,len:1216
ho 0 tail 12 room 4
load:0x40078000,len:9720
ho 0 tail 12 room 4
load:0x40080400,len:6352
entry 0x400806b8
Waiting for SmartConfig.
.....
SmartConfig received.
Waiting for WiFi
WiFi Connected.
IP Address: 192.168.0.7
HTTP server started
Autoscroll
Show timestamp
Newline
115200 baud
Clear output
WebServer server(
uint8_t LED1pin =
bool LED1status =
uint8_t LED2pin =
bool LED2status =
void setup() {
Serial.begin(115
//Serial.begin(115
//Init WiFi as Sta
WiFi.mode(WIFI_AP_STA);
WiFi.beginSmartConfig();
Leaving...
Hard resetting via RTS pin...
ESP32 Dev Module on COM5
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12:45 PM
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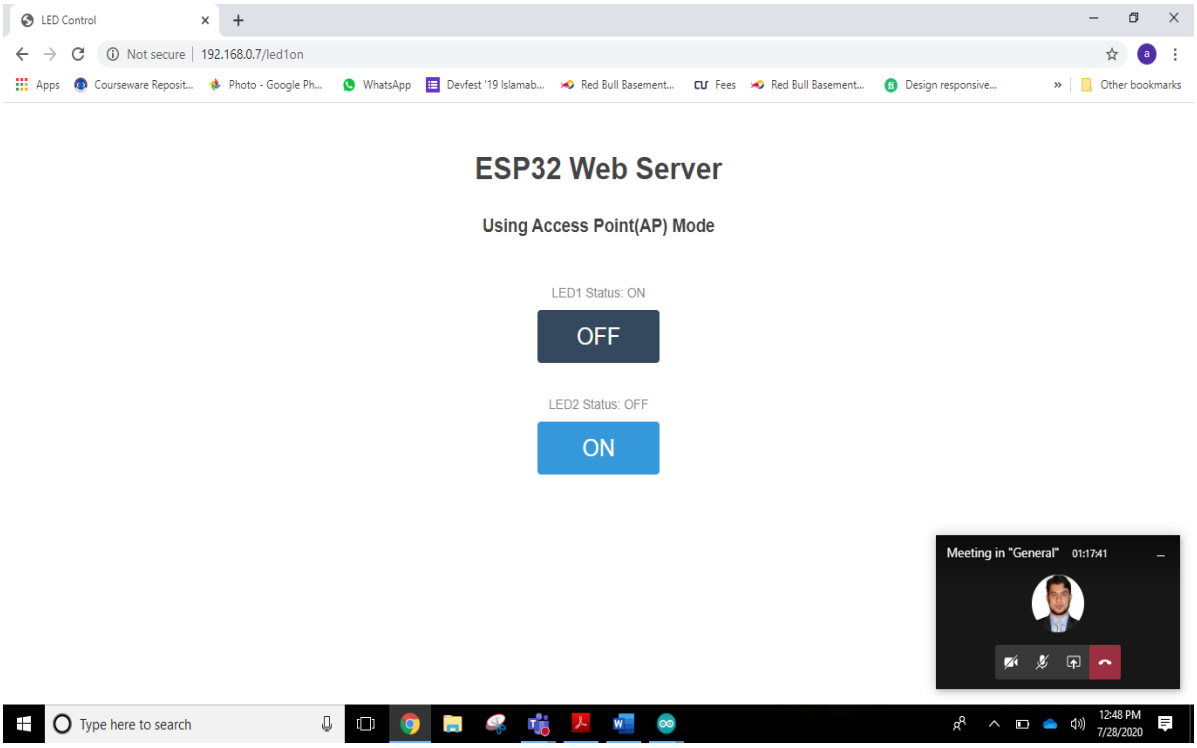
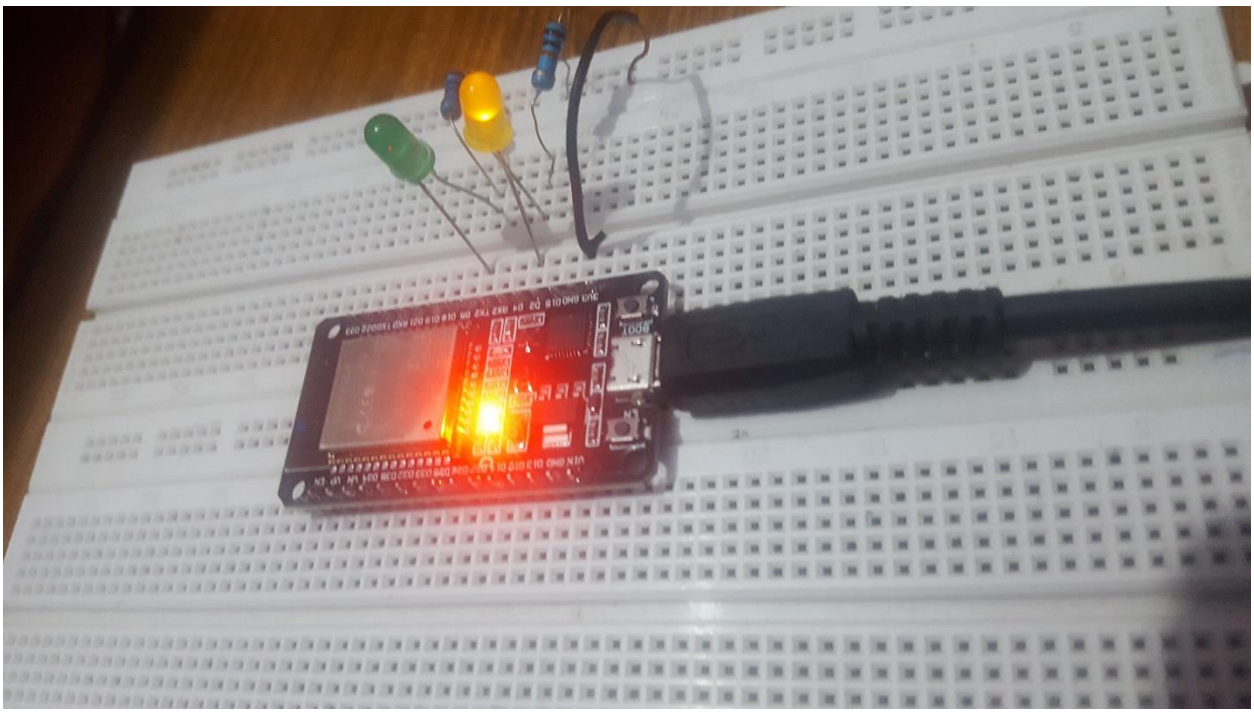

LED Control
Not secure | 192.168.0.7/led1on
Apps
Courseware Reposit...
Photo - Google Ph...
WhatsApp
Devfest '19 Islamab...
Red Bull Basement...
Fees
Red Bull Basement...
Design responsive...
Other bookmarks
ESP32 Web Server
Using Access Point(AP) Mode
LED1 Status: ON
OFF
LED2 Status: OFF
ON
Meeting in "General" 01:17:41
Type here to search
12:48 PM
7/28/2020

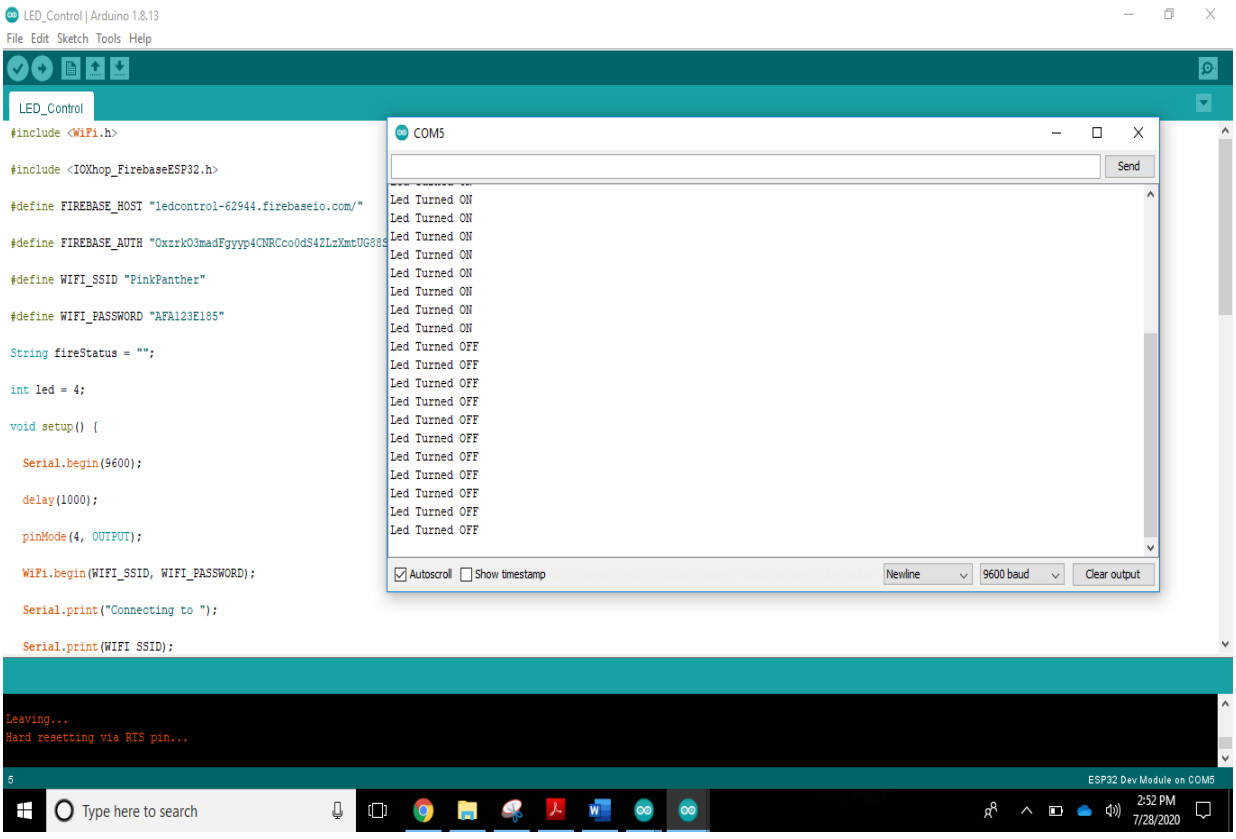


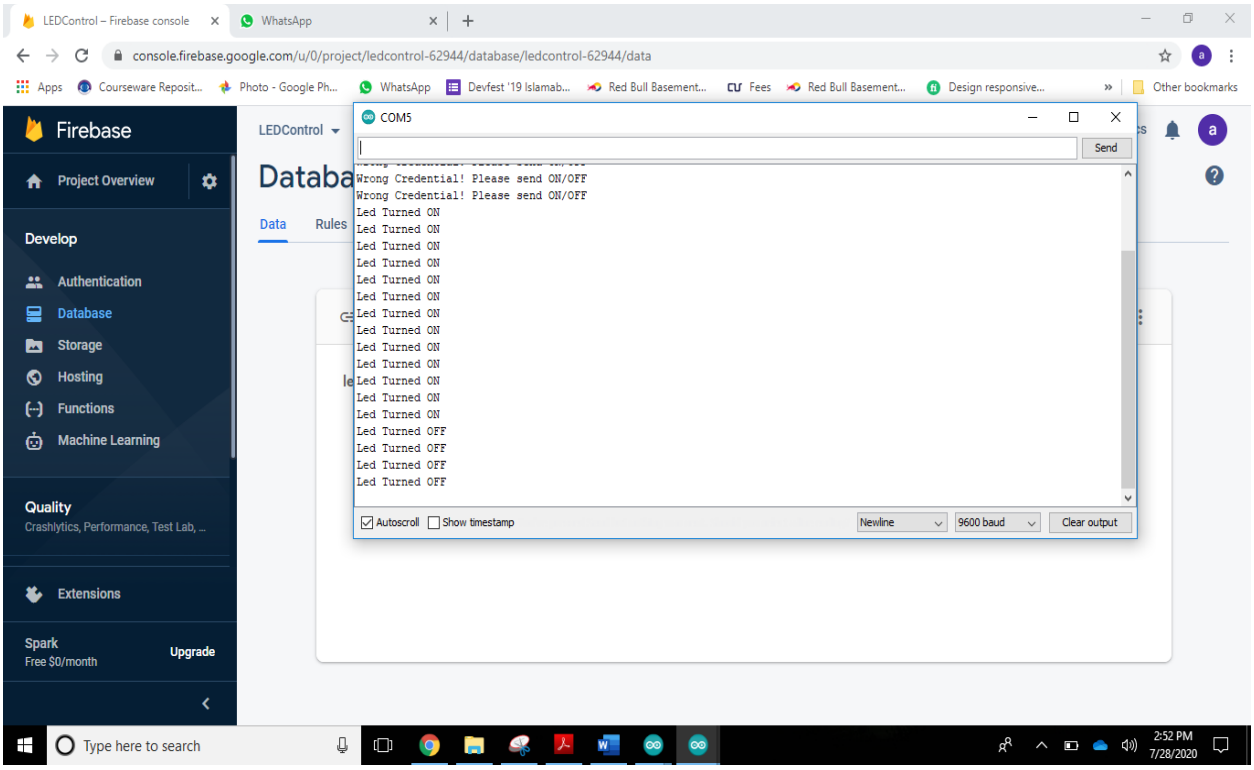
Task 3

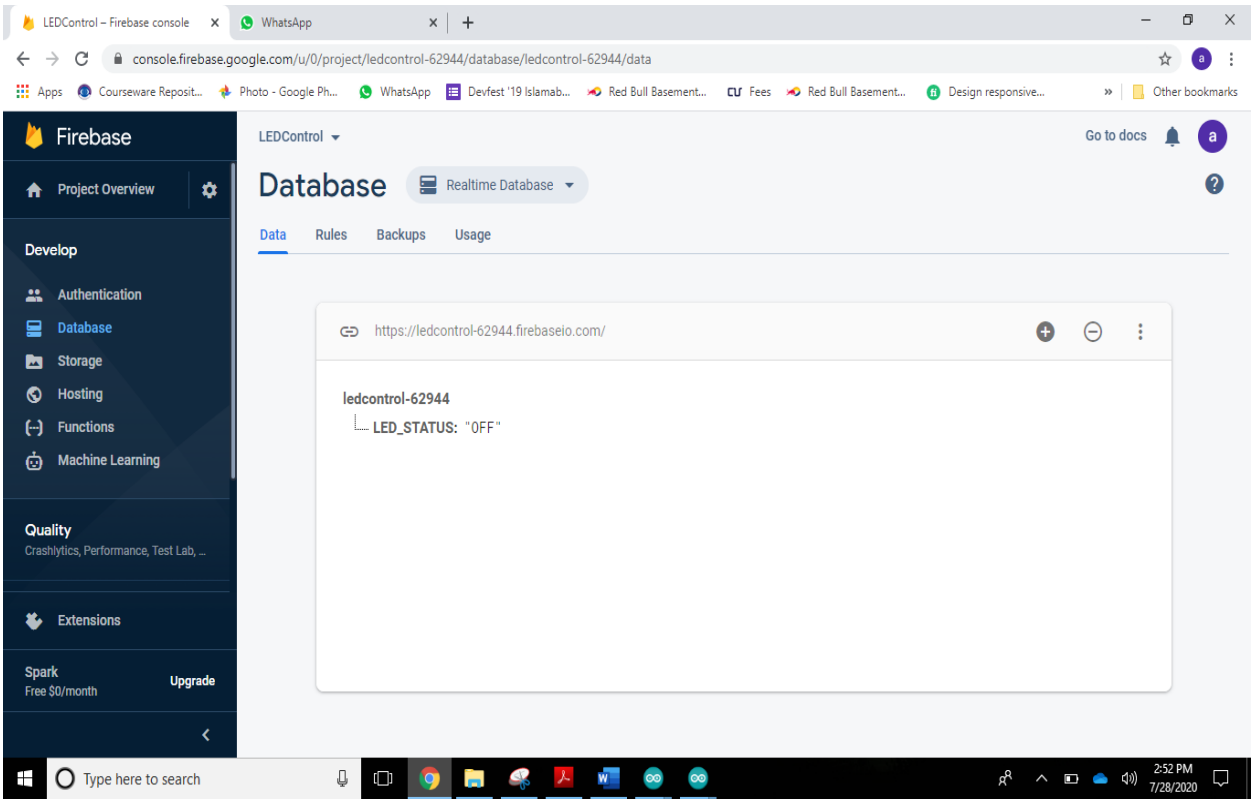
LED control using Google Firebase and ESP32

```
#include <WiFi.h>
#include <IOXhop_FirebaseESP32.h>
#define FIREBASE_HOST "ledcontrol-62944.firebaseio.com/"
#define FIREBASE_AUTH "OxzrkO3madFgyyp4CNRCco0dS4ZLzXmtUG88SJ5k"
#define WIFI_SSID "PinkPanther"
#define WIFI_PASSWORD "AFA123E185"
 String fireStatus = "";                                    // led status received from firebase
int led = 4;
void setup() {
  Serial.begin(9600);
  delay(1000);
  pinMode(4, OUTPUT);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);                          //try to connect with wifi
  Serial.print("Connecting to ");
  Serial.print(WIFI_SSID);
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
  }
  Serial.println();
  Serial.print("Connected to ");
  Serial.println(WIFI_SSID);
  Serial.print("IP Address is : ");
```

```
  Serial.println(WiFi.localIP());                                    //print local IP address
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);                      // connect to firebase
  Firebase.setString("LED_STATUS", "OFF");                           //send initial string of led status
}
void loop() {
  fireStatus = Firebase.getString("LED_STATUS");                     // get led status input from firebase
  if (fireStatus == "ON") {                    // compare the input of led status received from firebase
    Serial.println("Led Turned ON");
    digitalWrite(4, HIGH);                                           // make output led ON
  }
  else if (fireStatus == "OFF") {              // compare the input of led status received from firebase
    Serial.println("Led Turned OFF");
    digitalWrite(4, LOW);                                            // make output led OFF
  }
  else {
    Serial.println("Wrong Credential! Please send ON/OFF");
  }
}
```




LEDControl – Firebase console
WhatsApp
console.firebase.google.com/u/0/project/ledcontrol-62944/database/ledcontrol-62944/data
Firebase
Project Overview
Develop
Authentication
Database
Storage
Hosting
Functions
Machine Learning
Quality
Crashlytics, Performance, Test Lab, ...
Extensions
Spark
Free $0/month
Upgrade
LEDControl
Data
Rules
COM5
Send
Wrong Credential! Please send ON/OFF
Wrong Credential! Please send ON/OFF
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned ON
Led Turned OFF
Led Turned OFF
Led Turned OFF
Led Turned OFF
Autoscroll
Show timestamp
Newline
9600 baud
Clear output
Type here to search
2:52 PM
7/28/2020


LEDControl – Firebase console
WhatsApp
console.firebase.google.com/u/0/project/ledcontrol-62944/database/ledcontrol-62944/data
Firebase
Project Overview
Develop
Authentication
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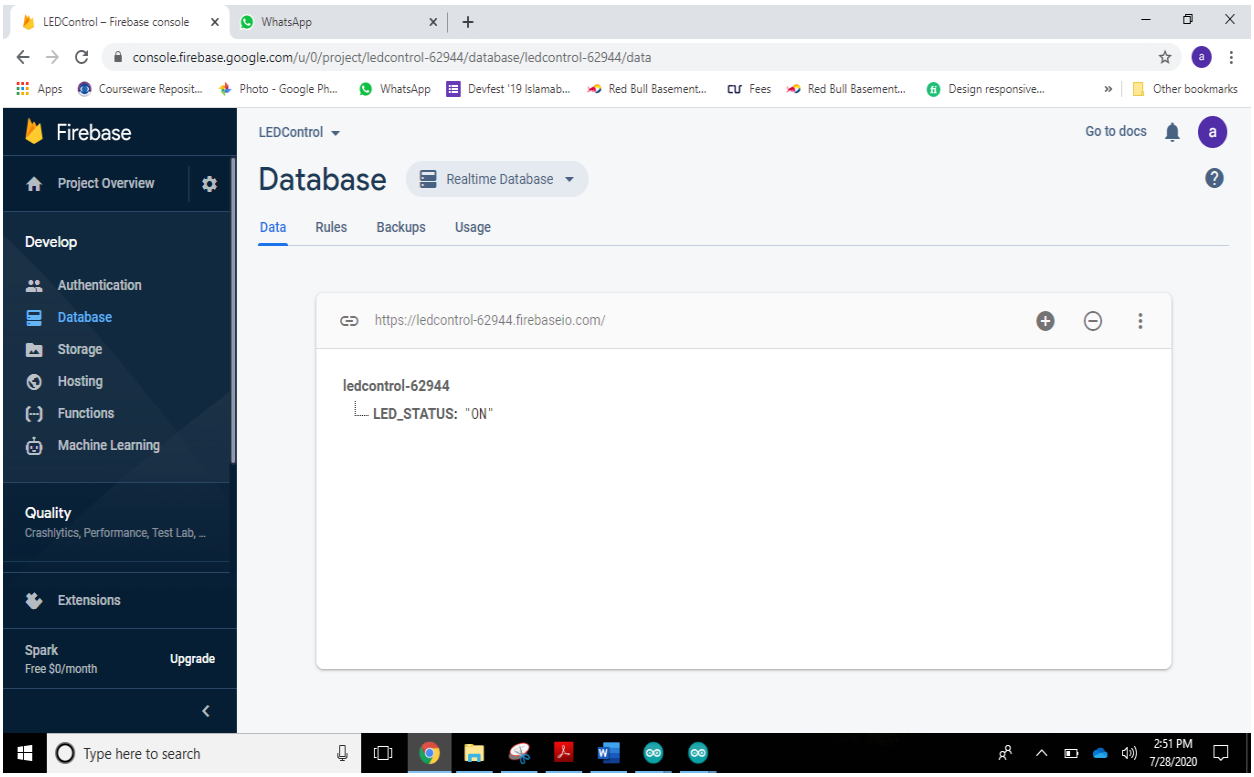
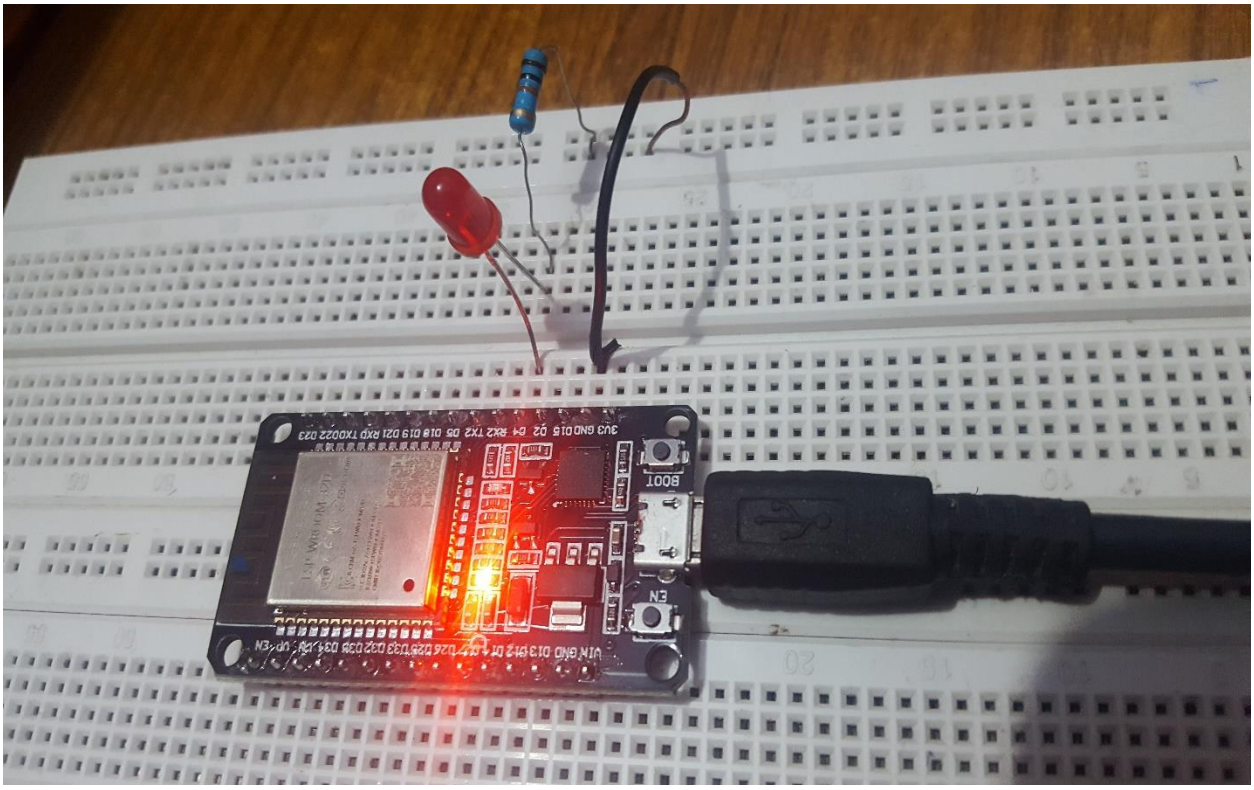
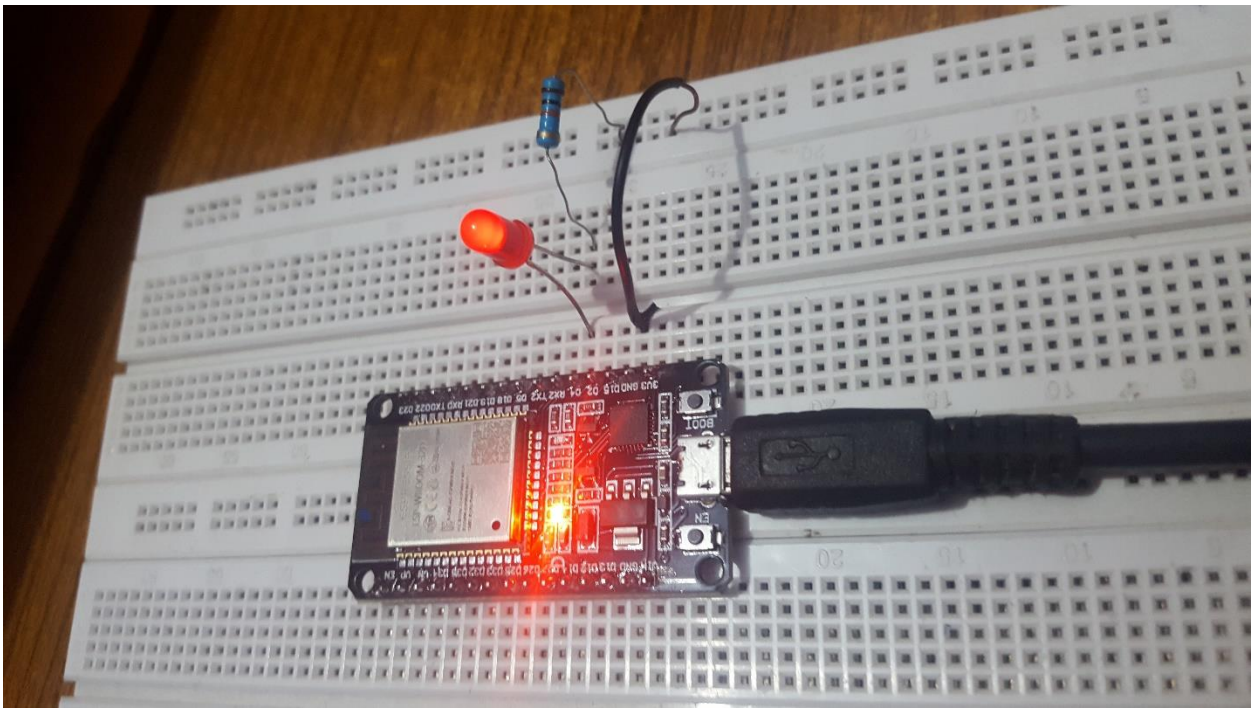
Machine Learning
Quality
Crashlytics, Performance, Test Lab, ...
Extensions
Spark
Free $0/month
Upgrade
LEDControl
Go to docs
Database
Realtime Database
Data
Rules
Backups
Usage
https://ledcontrol-62944.firebaseio.com/
ledcontrol-62944
LED_STATUS: "OFF"
Type here to search
2:52 PM
7/28/2020


LEDControl – Firebase console
WhatsApp
console.firebase.google.com/u/0/project/ledcontrol-62944/database/ledcontrol-62944/data
Firebase
Project Overview
Develop
Authentication
Database
Storage
Hosting
Functions
Machine Learning
Quality
Crashlytics, Performance, Test Lab, ...
Extensions
Spark
Free $0/month
Upgrade
LEDControl
Go to docs
Database
Realtime Database
Data
Rules
Backups
Usage
https://ledcontrol-62944.firebaseio.com/
ledcontrol-62944
LED_STATUS: "ON"
Type here to search
2:51 PM
7/28/2020





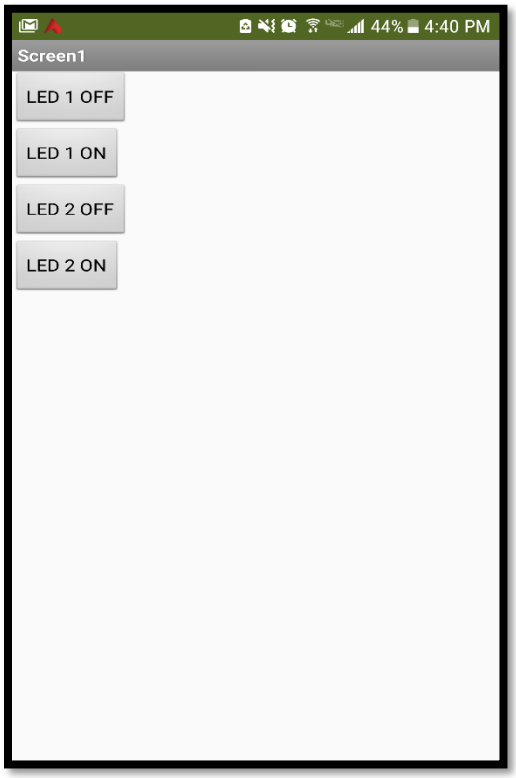
Task 4

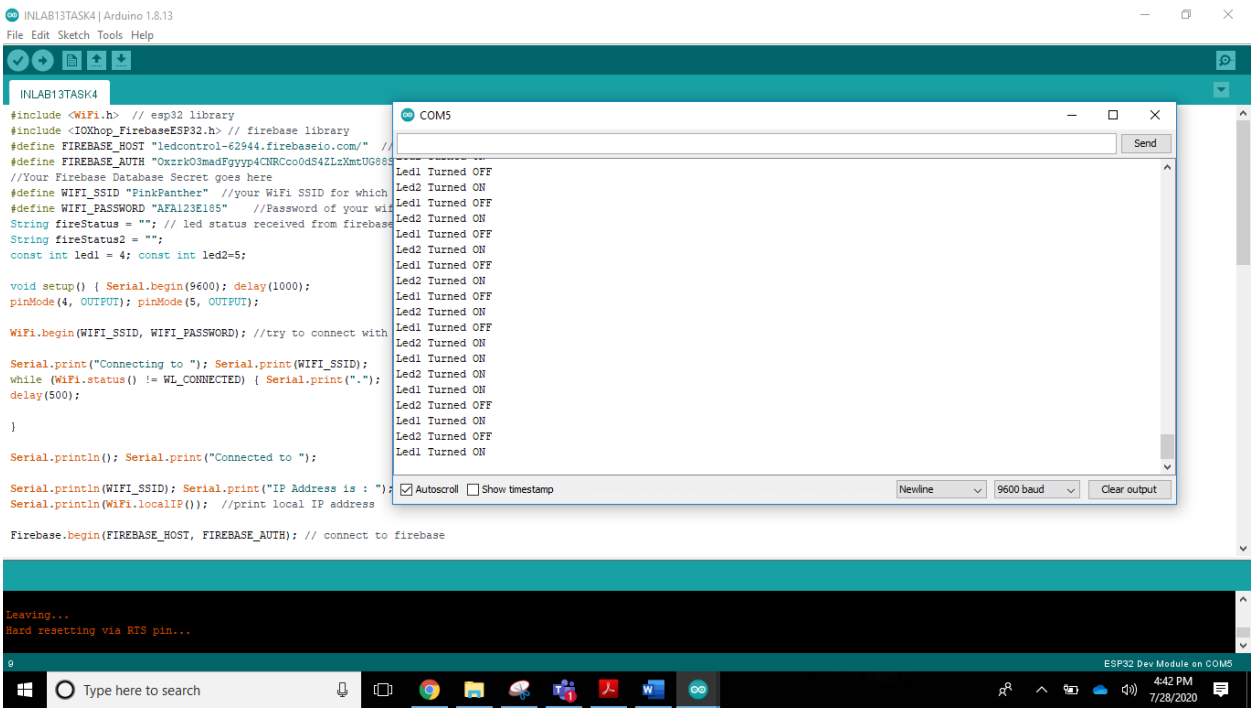
LED control using Google Firebase, ESP32 and Mobile App

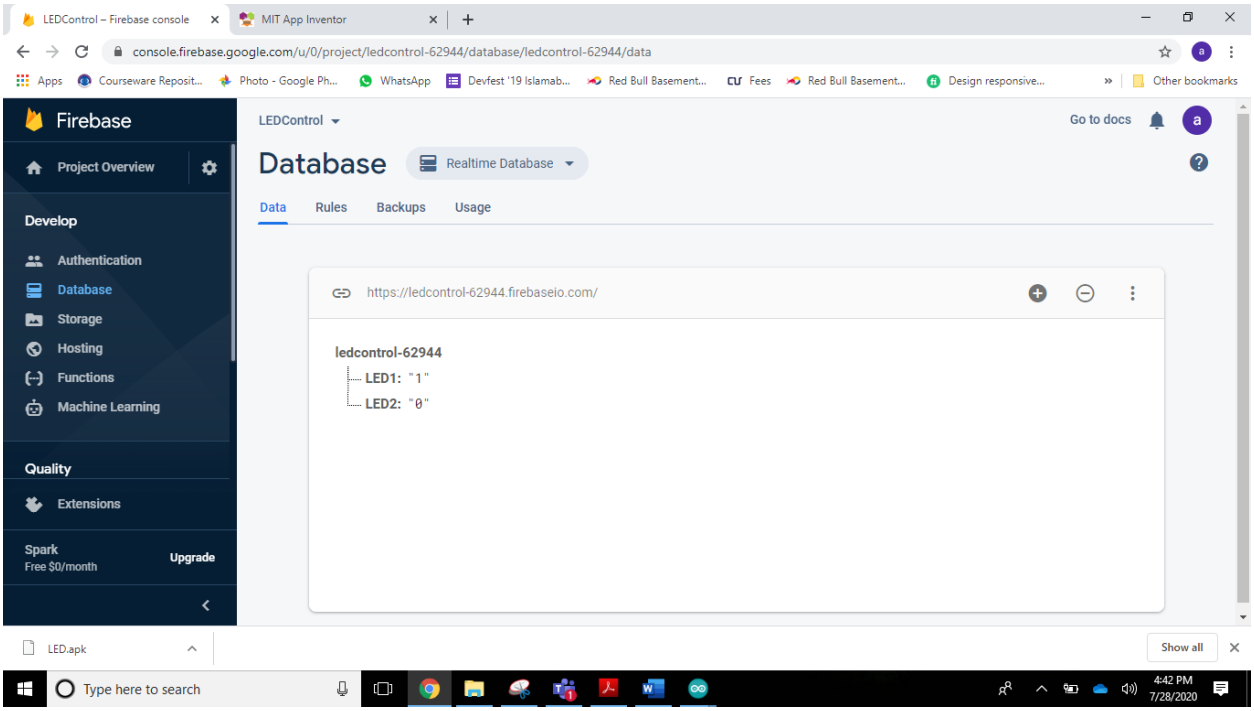
```
#include <WiFi.h>  // esp32 library
#include <IOXhop_FirebaseESP32.h> // firebase library
#define FIREBASE_HOST "ledcontrol-62944.firebaseio.com/"  //Your Firebase //Project URL goes here without
"http:" , "\" and "/"
#define FIREBASE_AUTH "OxzrkO3madFgyyp4CNRCco0dS4ZLzXmtUG88SJ5k"
//Your Firebase Database Secret goes here
#define WIFI_SSID "PinkPanther"  //your WiFi SSID for which yout NodeMCU connects
#define WIFI_PASSWORD "AFA123E185"    //Password of your wifi network
String fireStatus = ""; // led status received from firebase
String fireStatus2 = "";
const int led1 = 4; const int led2=5;
void setup() { Serial.begin(9600); delay(1000);
pinMode(4, OUTPUT); pinMode(5, OUTPUT);
WiFi.begin(WIFI_SSID, WIFI_PASSWORD); //try to connect with wifi
Serial.print("Connecting to "); Serial.print(WIFI_SSID);
while (WiFi.status() != WL_CONNECTED) { Serial.print(".");
delay(500);
}
Serial.println(); Serial.print("Connected to ");
Serial.println(WIFI_SSID); Serial.print("IP Address is : ");
Serial.println(WiFi.localIP());  //print local IP address
Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH); // connect to firebase
Firebase.setString("LED1", "0");  //send initial string of led status
Firebase.setString("LED2", "0");
}
void loop() {
fireStatus = Firebase.getString("LED1");  // get led status input from firebase
if (fireStatus == "1") {  // compare the input of led status received from firebase
Serial.println("Led1 Turned ON");
digitalWrite(4, HIGH);  // make output led ON
}
else if (fireStatus == "0") { // compare the input of led status received from firebase
Serial.println("Led1 Turned OFF");
digitalWrite(4, LOW); // make output led OFF
}
else {
Serial.println("Wrong Credential for LED1! Please send ON/OFF");
}
fireStatus2 = Firebase.getString("LED2");
if (fireStatus2 == "1") {  // compare the input of led status received from firebase
Serial.println("Led2 Turned ON");
digitalWrite(5, HIGH);  // make output led ON
}
else if (fireStatus2 == "0") {  // compare the input of led status received from firebase
Serial.println("Led2 Turned OFF");
digitalWrite(5, LOW); // make output led OFF
}
else {
```

```
Serial.println("Wrong Credential for LED2! Please send ON/OFF");

}
}
```






LEDControl – Firebase console
MIT App Inventor
console.firebase.google.com/u/0/project/ledcontrol-62944/database/ledcontrol-62944/data
Firebase
Project Overview
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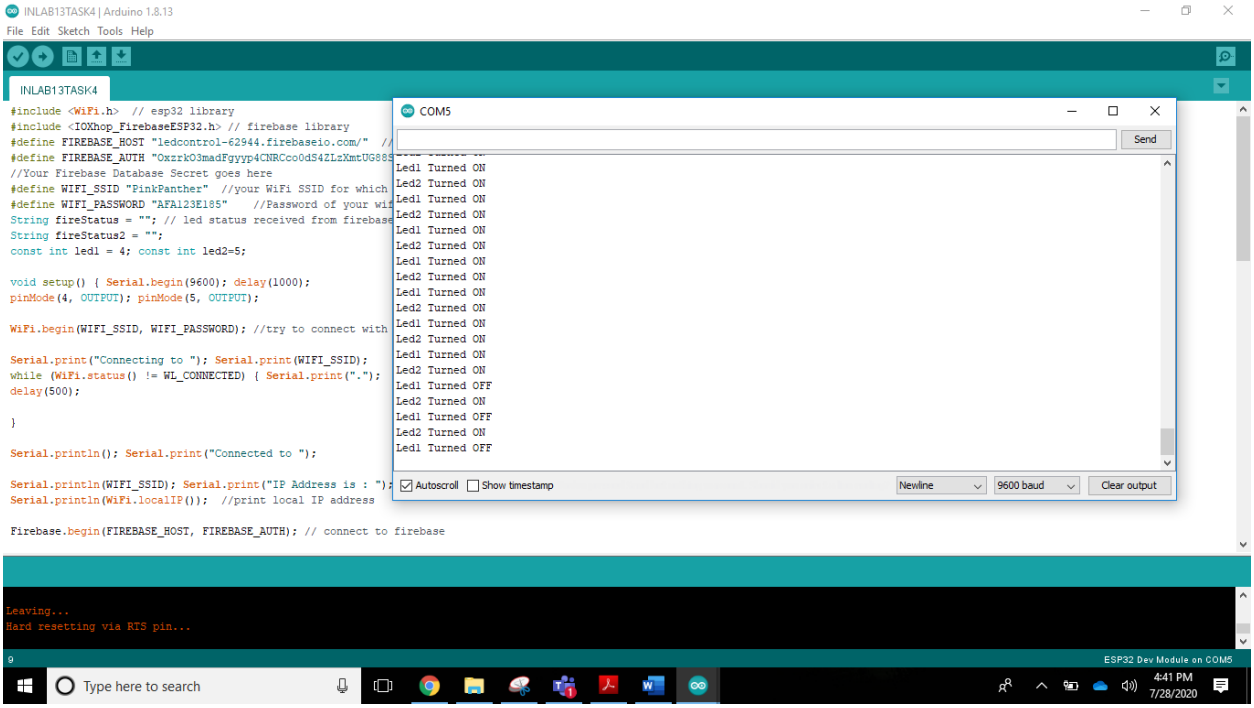
Storage
Hosting
Functions
Machine Learning
Quality
Extensions
Spark
Free $0/month
Upgrade
LEDControl
Go to docs
Database
Realtime Database
Data
Rules
Backups
Usage
https://ledcontrol-62944.firebaseio.com/
ledcontrol-62944
LED1: "1"
LED2: "0"
LED.apk
Show all
Type here to search
4:42 PM
7/28/2020


INLAB13TASK4 | Arduino 1.8.13
File Edit Sketch Tools Help
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Serial.println(WiFi.localIP()); //print local IP address
Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH); // connect to firebase
COM5
Send
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned OFF
Led2 Turned ON
Led1 Turned OFF
Led2 Turned ON
Led1 Turned OFF
Autoscroll
Show timestamp
Newline
9600 baud
Clear output
Leaving...
Hard resetting via RTS pin...
9
ESP32 Dev Module on COM5
Type here to search
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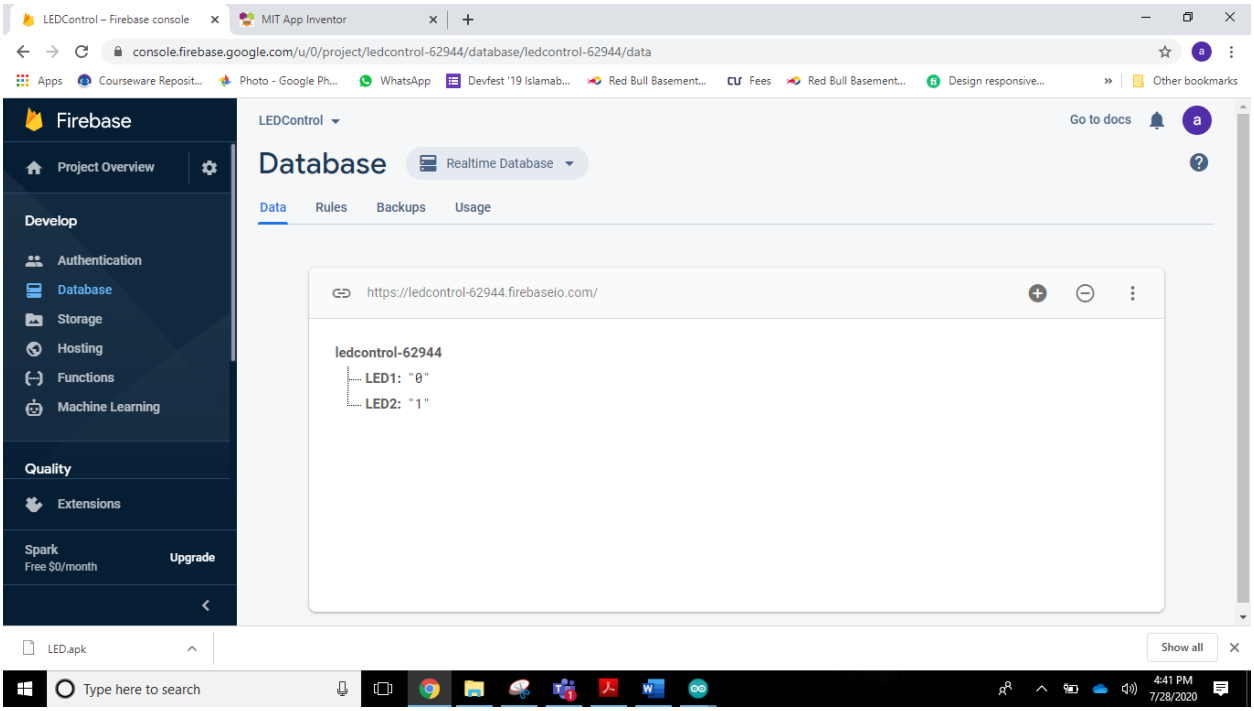
7/28/2020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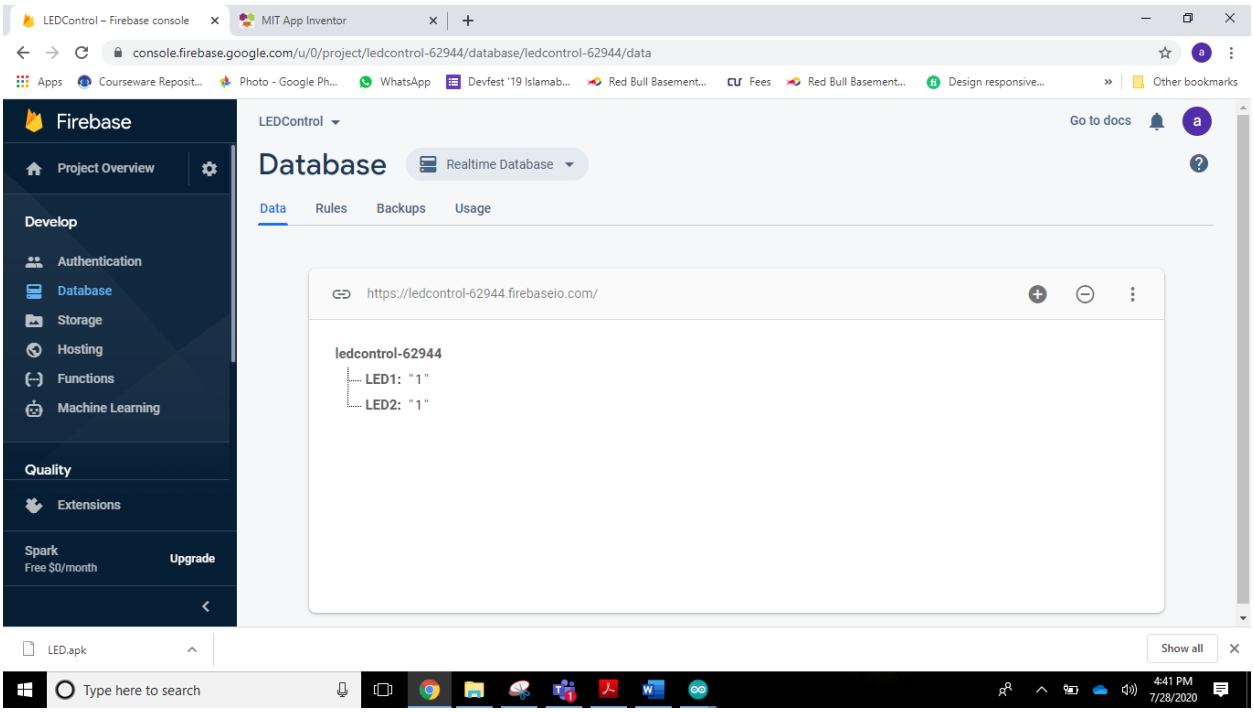
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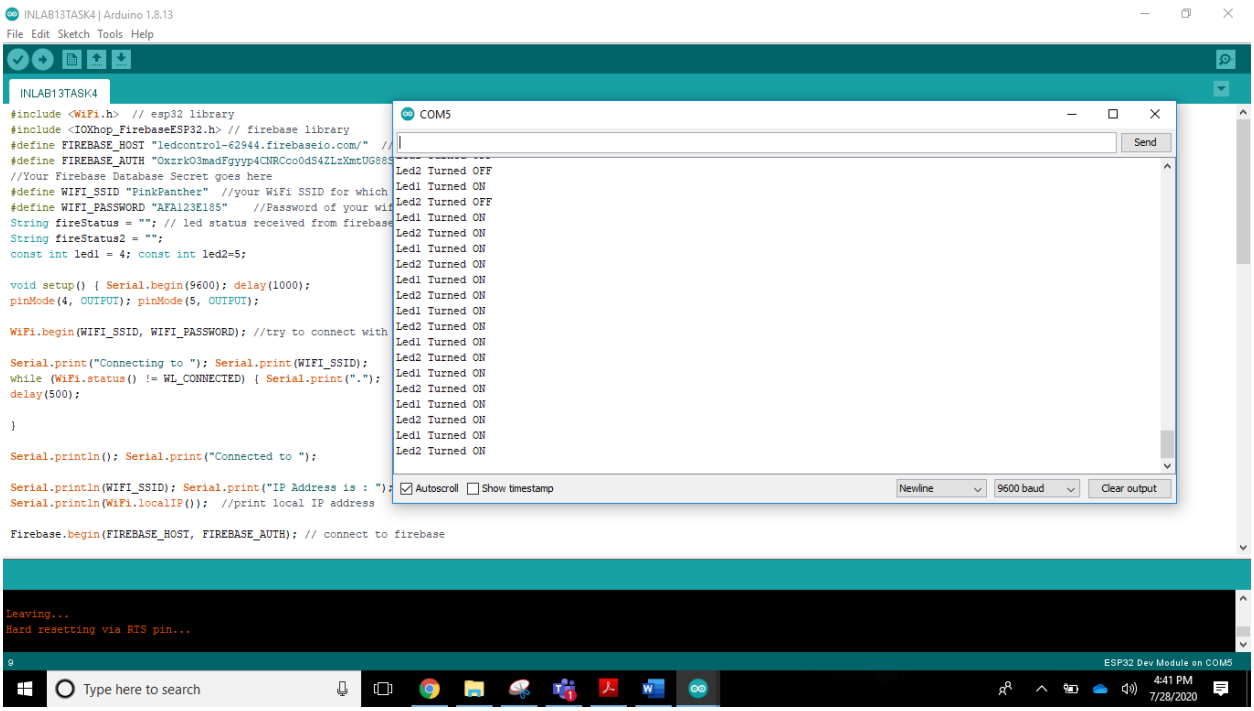
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Led1 Turned ON
Led2 Turned OFF
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
Led1 Turned ON
Led2 Turned ON
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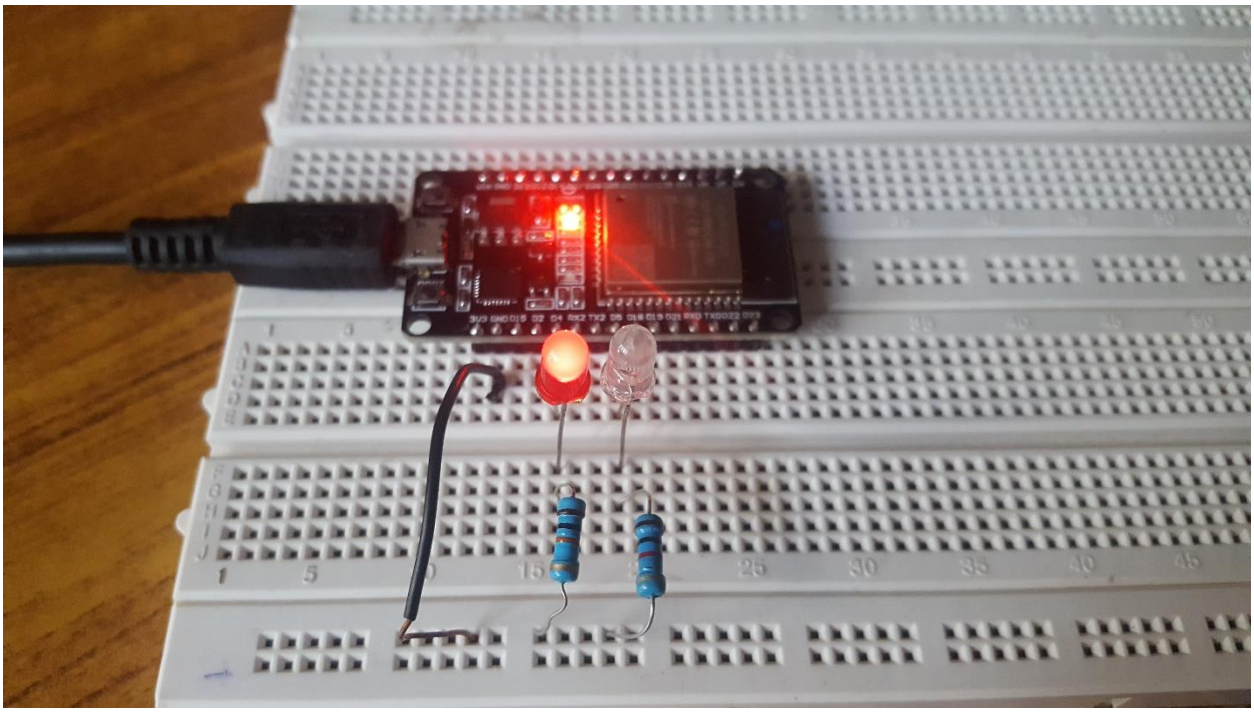

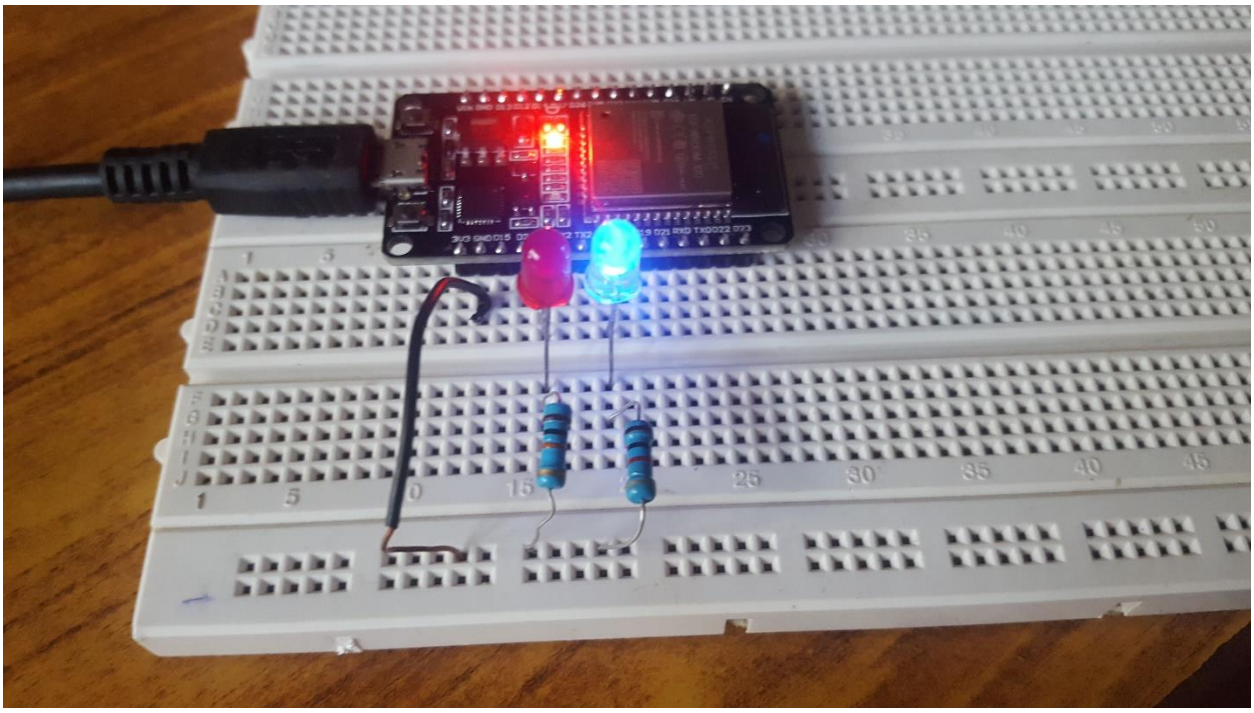

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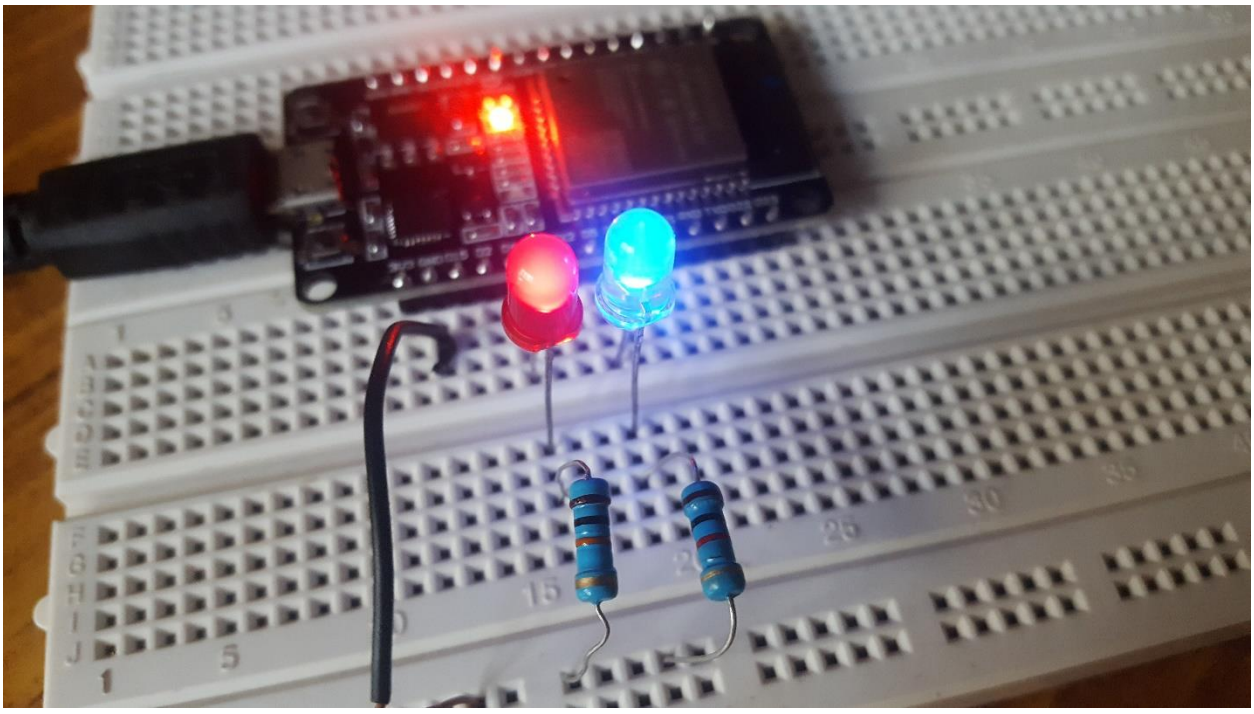

Conclusion:

In this lab we learnt how to make an Android Application using MIT App Inventer, connect it to the database and read the data from that database using and ESP32. We also learnt how to make a Real Time Database on Google Firebase.