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Degree & Branch: B.Tech - Final Year - Information Technology

College: Government College of Technology, Coimbatore – 641 013

Subject: Professional Readiness for Innovation, Employability & Entrepreneurship (Nalaiya Thiran)

Assignment – 4 ESP32 with Ultrasonic Senor and IoT Watson

Task – 1:

Write code and connections in wokwi for ultrasonic sensor. Whenever distance is less than 100 cms send "alert" to ibm cloud and display in device recent events. Upload document with wokwi share link and images of ibm cloud

Solution:

Program:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQtt
#define TRIG_PIN 2 // ESP32 pin GIOP23 connected to Ultrasonic Sensor's TRIG pin
#define ECHO_PIN 4 // ESP32 pin GIOP22 connected to Ultrasonic Sensor's ECHO pin
#define DHTTYPE DHT11   // define type of sensor DHT 11

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

//-------credentials of IBM Accounts------

#define ORG "*****"//IBM ORGANITION ID
#define DEVICE_TYPE "*****"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "******"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "******"     //Token
String data3;
float duration_us, distance_cm;


char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform
and format in which data to be send
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd  REPRESENT command type AND
COMMAND IS TEST OF FORMAT STRING
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id


//-------------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client
id by passing parameter like server id,portand wificredential
```

```
void setup()// configureing the ESP32
{
  Serial.begin(115200);
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}


void loop()// Recursive Function
{
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);
  // measure duration of pulse from ECHO pin
  duration_us = pulseIn(ECHO_PIN, HIGH);
  // calculate the distance
  distance_cm = 0.017 * duration_us;
  // print the value to Serial Monitor
  Serial.print("distance: ");
  Serial.print(distance_cm);
  Serial.println(" cm");
  delay(500);
  if(distance_cm<100){
    PublishData(distance_cm);
  }
  delay(1000);
  if (!client.loop()) {
    mqttconnect();
  }
}


/*.....retrieving to Cloud.....*/

void PublishData(float distance_cm)
{
  mqttconnect();//function call for connecting to ibm
  /*
     creating the String in in form JSon to update the data to ibm cloud
  */
  String payload = "{\"Alert\":\"ON\"";
  payload += "," "\"Distance_cm\":";
  payload += distance_cm;
  payload += "}";

  Serial.print("Sending payload: ");
  Serial.println(payload);

  if (client.publish(publishTopic, (char*) payload.c_str())) {
    Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it
will print publish ok in Serial monitor or else it will print publish failed
  } else {
    Serial.println("Publish failed");
  }
}


void mqttconnect()
{
  if (!client.connected())
  {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!!!client.connect(clientId, authMethod, token))
    {
      Serial.print(client.connect(clientId, authMethod, token));
      Serial.print(".");
      delay(500);
    }
     initManagedDevice();
     Serial.println();
  }
}


void wificonnect() //function defination for wificonnect
{
  Serial.println();
  Serial.print("Connecting to ");

  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the
connection
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}
```

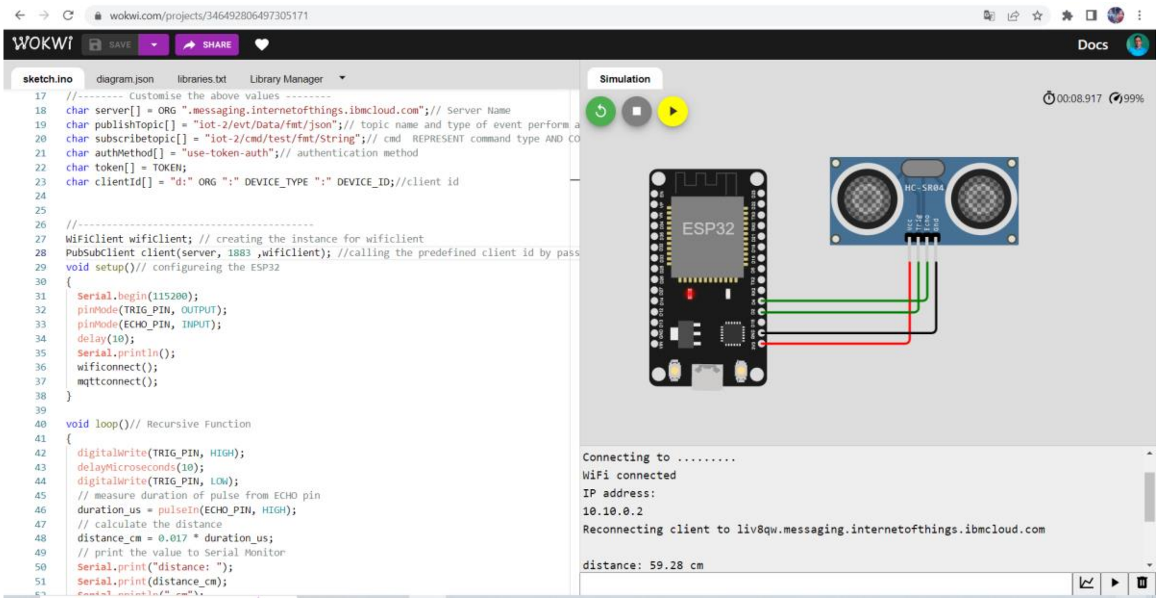
Output of Program:

Wokwi Project Link:

https://wokwi.com/projects/346492806497305171

Note: The IBM Cloud Credentials of My Device is replaced with * please include your IBM Cloud Device credentials before runninig the Simulation

Wokwi Website Screenshot:



```
//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform a
char subscribetopic[] = "iot-2/cmd/test/fmt/String";// cmd  REPRESENT command type AND CO
char authMethod[] = "use-token-auth";// authentication method
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id


//-----------------------------------------
WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883 ,wifiClient); //calling the predefined client id by pass
void setup()// configureing the ESP32
{
  Serial.begin(115200);
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  delay(10);
  Serial.println();
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  mqttconnect();
}

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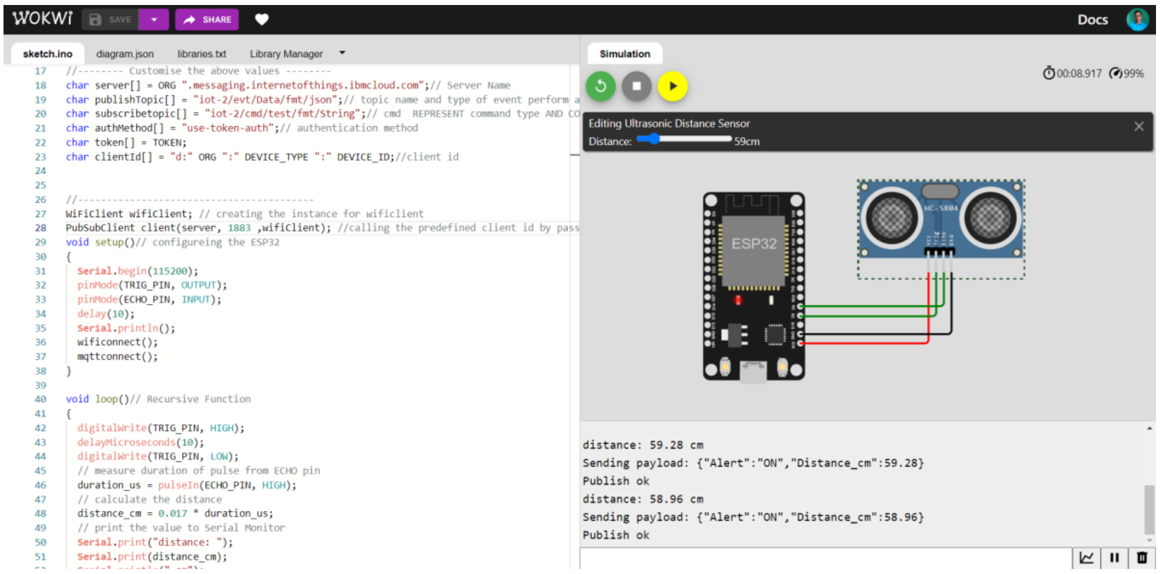
  digitalWrite(TRIG_PIN, LOW);
  // measure duration of pulse from ECHO pin
  duration_us = pulseIn(ECHO_PIN, HIGH);
  // calculate the distance
  distance_cm = 0.017 * duration_us;
  // print the value to Serial Monitor
  Serial.print("distance: ");
  Serial.print(distance_cm);
```

```
Connecting to .........
WiFi connected
IP address:
10.10.0.2
Reconnecting client to liv8qw.messaging.internetofthings.ibmcloud.com

distance: 59.28 cm
```



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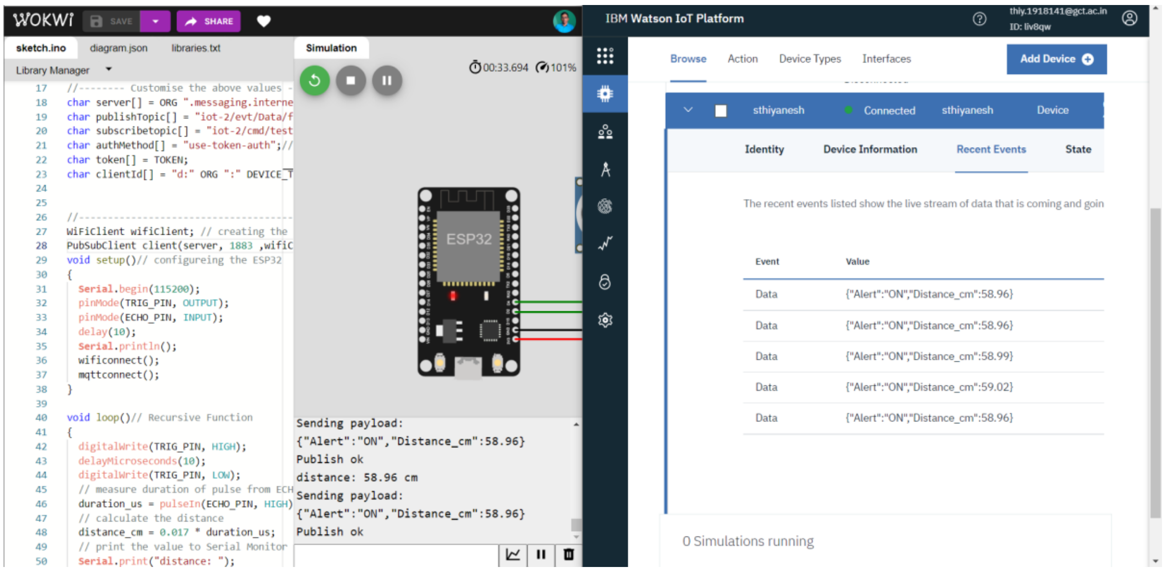
  digitalWrite(TRIG_PIN, LOW);
  // measure duration of pulse from ECHO pin
  duration_us = pulseIn(ECHO_PIN, HIGH);
  // calculate the distance
  distance_cm = 0.017 * duration_us;
  // print the value to Serial Monitor
  Serial.print("distance: ");
  Serial.print(distance_cm);
```

```
distance: 59.28 cm
Sending payload: {"Alert":"ON","Distance_cm":59.28}
Publish ok
distance: 58.96 cm
Sending payload: {"Alert":"ON","Distance_cm":58.96}
Publish ok
```

IBM Cloud Screenshot:



```
//-------- Customise the above values -
char server[] = ORG ".messaging.interne
char publishTopic[] = "iot-2/evt/Data/f
char subscribetopic[] = "iot-2/cmd/test
char authMethod[] = "use-token-auth";//
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_T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PubSubClient client(server, 1883 ,wifiC
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  duration_us = pulseIn(ECHO_PIN, HIGH)
  // calculate the distance
  distance_cm = 0.017 * duration_us;
  // print the value to Serial Monitor
  Serial.print("distance: ");
```

```
Sending payload:
{"Alert":"ON","Distance_cm":58.96}
Publish ok
distance: 58.96 cm
Sending payload:
{"Alert":"ON","Distance_cm":58.96}
Publish ok
```

sthiyanesh	Connected	sthiyanesh	Device

The recent events listed show the live stream of data that is coming and goin

Event	Value
Data	{"Alert":"ON","Distance_cm":58.96}
Data	{"Alert":"ON","Distance_cm":58.96}
Data	{"Alert":"ON","Distance_cm":58.99}
Data	{"Alert":"ON","Distance_cm":59.02}
Data	{"Alert":"ON","Distance_cm":58.96}

Explanation of Program:

Initially, we have imported the <Wifi.h> and <PubSubClient.h> header files as they are needed to connect wifi and MQTT Protocol. Then, Define Trigger pin and Echo pin values where the ultrasonic sensor is connected with ESP32 module. Then, Define the IBM Account Credentials such as ORG, Device_Type, Device_ID and Token. Also define the server, publishTopic, SubscribeTopic, authMethod, Token and ClientID. Create Object for WifiClient and PubSubClient.

Then, Start the void Setup() Function, Begin the Serial Monitor and set PinMode of Trigger Pin as Output and Echo Pin as Input and call wificonnect() and mqttconnect() to initialize wifi and mqtt Connection and Define their methods to make the Connection.

Then, Begin the void loop() function, digitalWrite HIGH to Trigger Pin and create a delay of 10 microseconds and write back LOW. Then, use pulseIn() function with Echo Pin to calculate the Duration and calculate the distance. If the Distance is less than 100cm call PublishData() Function to publish the Data to IoT Watson Device.

Finally, Define the PublishData() function with message as parameter. Then Define string that contains the payload with the message to be sent in the Json Format. Call Client.publish() function with publishTopic and payload as parameter. Also define the wificonnect() and mqttconnect() to make intial connection with wifi and mqtt connection.