

[ESP8266 Projects](#) [IoT Projects](#)

IoT Water Flow Meter using ESP8266 & Water Flow Sensor

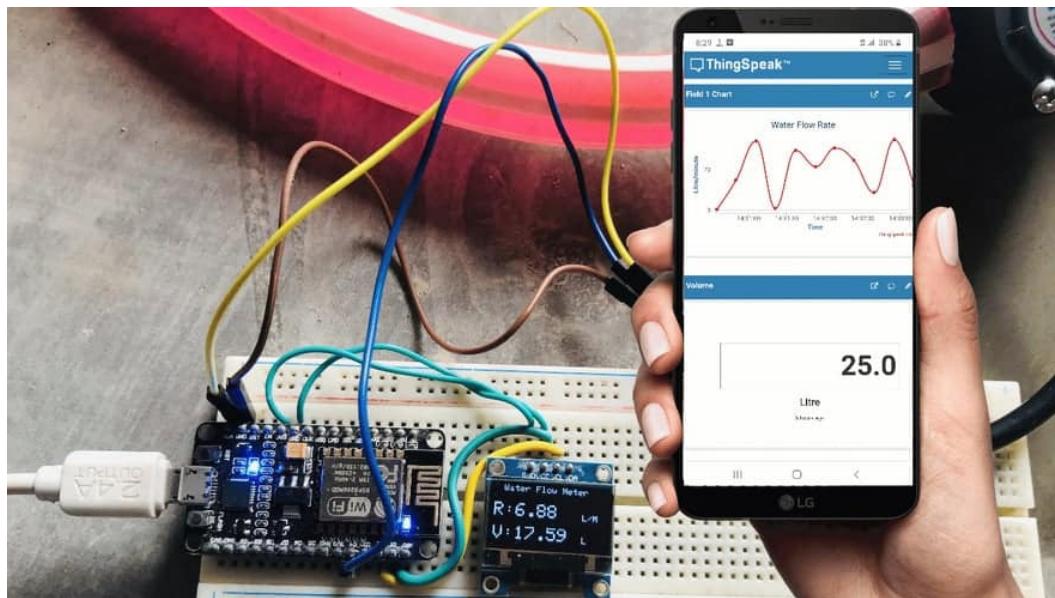
Admin Last Updated: August 21, 2022 44 40,593 5 minutes read

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Overview: IoT Water Flow Meter using ESP8266 & Water Flow Sensor

In this project we will learn how to make IoT Based Water Flow Meter using ESP8266 & Water Flow Sensor. We will interface YFS201 Hall Effect Water Flow Sensor with NodeMCU ESP8266 Board. We will display the **water flow rate** & **Total Volume** in 0.96" OLED Display. We will then integrate the hardware with **IoT Server**. For IoT Server, we will use **Thingspeak App**. The water flow rate & volume data can be uploaded to **Thingspeak Server** & can be viewed/monitored from any part of the world.

Water Management System is an important part of City Management. Water management involves supplying water according to the real requirement & without wasting Water. Therefore it is very important to measure water flow rate and volume. Without measuring these parameters, Water Management is almost impossible. Also monitoring the **Water Volume, Flow Rate & Water Quality** remotely using **Internet Connectivity** has become very essential. Therefore there is a need for **Monitoring Water Management System Online**.

There are so many **Water Flow Sensors** available in the market but are too expensive to use and afford. As a result, a **low-cost** water flow meter is required. So we will use **YFS201 Hall Effect Water Flow Sensor** with ESP8266 & design simple IoT Based Water Flow Meter.

Bill of Materials

Following are the **components** required for making this project. All the components can be easily purchased from **Amazon**. The component purchase link is given below.

S.N.	COMPONENTS NAME	DESCRIPTION	QUANTITY	
1	NodeMCU	ESP8266-12E Board	1	https://amzn.to/3LqfJyD
2	Water Flow Sensor	YF-S201 Hall-Effect Water Flow Sensor	1	https://amzn.to/3LqfJyD
3	OLED Display	0.96" I2C OLED Display	1	https://amzn.to/3LqfJyD
4	Connecting Wires	Jumper Wires	10	https://amzn.to/3LqfJyD
5	Breadboard	-	1	https://amzn.to/3LqfJyD

YF-S201 Hall-Effect Water Flow Sensor



This is an image of the [YF-S201 Hall-Effect Water Flow Sensor](#).

This sensor can be connected to the waterline as it has both inlet and outlet. Inside the sensor, there is a pinwheel that measures how much liquid has moved through it. There's an integrated **magnetic hall effect sensor** that outputs an **electrical pulse** with every revolution.



The sensor comes with three wires:

1. Red (**5-24VDC power**)
2. Black (**ground**)
3. Yellow (**Hall effect pulse output**)

The water flow rate can be calculated by counting the pulses from the output of the sensor. Each pulse is approximately **2.25 milliliters**. This Sensor is cheaper and best but not the accurate one as flow rate/volume varies a bit depending on the flow rate, fluid pressure, and sensor orientation. To get better precision of more than **10%**, a lot of **calibration** is required. You can make a basic IoT Based Water Flow Meter using this Sensor.

The pulse signal is a simple **square wave** so its quite easy to log and convert into liters per minute using the following formula.

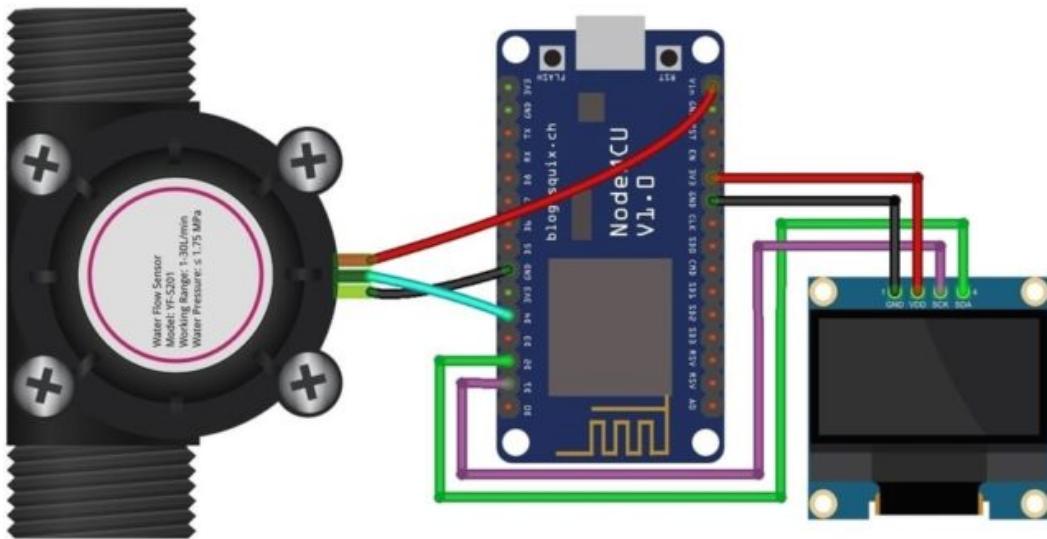
$$\text{Pulse frequency (Hz)} / 7.5 = \text{flow rate in L/min}$$

To learn more about this sensor, you can follow our previous guide here: [Arduino & Water Flow Sensor Complete Hookup Guide](#)

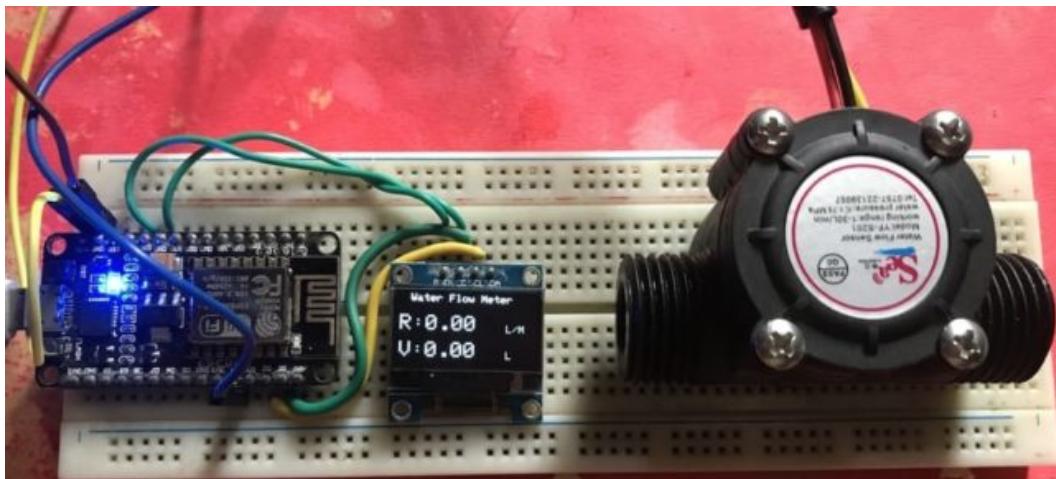
IoT Water Flow Meter using ESP8266 & Water Flow Sensor

Now let us interface YF-S201 Hall-Effect Water Flow Sensor with **Nodemcu ESP8266 & OLED Display**. The OLED Display will show **Water Flow Rate & Total Volume** of Water passed through the pipe. The same Flow Rate & Volume data can be sent to **Thingspeak Server** after an interval of 15 seconds regularly. You can switch to **Blynk Application** if you want immediate data. Similarly using **MQTT Protocol** better wireless communication can be achieved.

But now let us see the IoT Water Flow Meter Circuit Diagram & Connection.



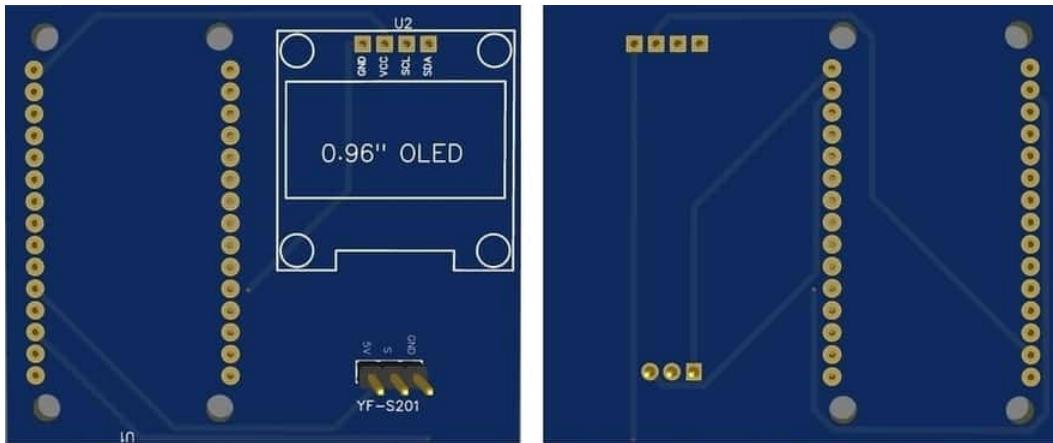
Water Flow Sensor is a **digital Sensor**, so we can connect its output pin to any of the digital pins of ESP8266. In my case, I connected to **GPIO2**, i.e **D4**. The sensor works at **5V** & can be connected to **Vin** of ESP8266. Similarly, I2C OLED Display **SDA** & **SCL** pins are connected to **D2** & **D1** of ESP8266 respectively. The OLED Display works at **3.3V** so it can be connected to **3.3V** pin of Nodemcu.



I have assembled the circuit on Breadboard. You can use the **custom-designed PCB** for making the small Water Flow Meter board.

PCB Designing & Ordering Online

The PCB for this project has been designed in EasyEDA online PCB making tool. Below is the front view and Back View of the PCB generated from .



Front View

Back View

The Gerber file for all the PCB is given below. You can download the Gerber file and order the PCB online from.

[Download Gerber File: IoT Water Flow Meter](#)

Now you can visit the NextPCB official website by clicking here: . So you will be directed to **NextPCB website**.



You can now upload the Gerber File to the Website and place an order. The PCB quality are clean and brilliant. That is why most of the people trust NextPCB for **PCB & PCBA Services**.

Mathematical Calculation to Measure Flow Rate & Volume

We have determined flow rate by a change in velocity of the water.

The water velocity depends on the pressure that forces the water through pipelines. The cross-sectional area of the pipe is known and remains constant, thus we calculate the average velocity that indicates the flow rate.

Let us consider Q is the flow rate/total flow of water through the pipe, V is the average velocity & A is the cross-sectional area of the pipe. In such a case the basic relationship for determining the liquid's flow rate in such cases is $Q=VxA$

Sensor Frequency (Hz) = 7.5 * Q (Liters/min)

Litres = Q * time elapsed (seconds) / 60 (seconds/minute)

Litres = (Frequency (Pulses/second) / 7.5) * time elapsed (seconds) / 60

Litres = Pulses / (7.5 * 60)

Setting up Thingspeak

Now we need to **setup the Thingspeak Account**. To set up Thingspeak follow the following Steps:



Step 1: Visit <https://thingspeak.com/> and create your account by filling up the details.

Step 2: Create a New Channel by Clicking on "Channel" & fill up the following details as shown in the image below.

A screenshot of the "Channel Settings" page on ThingSpeak. The URL in the browser bar is "thingspeak.com/channels/1083869/edit". The top navigation bar includes "Private View", "Public View", and "Channel Settings" (which is active).

Setting	Value
Percentage complete	30%
Channel ID	1083869
Name	Water Flow Meter
Description	(empty text area)
Field 1	Flow Rate <input checked="" type="checkbox"/>
Field 2	Volume <input checked="" type="checkbox"/>

Step 3: Click on API Key, you will see the “**Write API Key**”. Copy the API Key. This is very important, it will be required in Code Part.

Step 4: You can click on the “**Private View**” & customize the display window as you want.

So, that's all from the Thingspeak Setup Part. Now let us move to the programming Part.

Source Code/Program

Now Let us see **ESP8266 Water Flow Sensor Code** using Arduino IDE. The code can be directly uploaded to the NodeMCU Board. But before that we need few **Libraries** for OLED Display. So download the Library first and add it to the Arduino IDE.

1. [Download SSD1306 Library](#)
2. [Download Adafruit GFX Library](#)

```
String apiKey = "KBD1JSZTUKCXJ15V";
```

```
const char *ssid = "Alexahome";
const char *pass = "loranthus";
```

Change the Thingspeak API Key, Wifi SSID & Password from the line above.

The complete source code is given below.

```
#include <ESP8266WiFi.h>
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

#define SCREEN_WIDTH 128      // OLED display width, in pixels
#define SCREEN_HEIGHT 64       // OLED display height, in pixels
#define OLED_RESET -1         // Reset pin # (or -1 if sharing A4)
#define LED_BUILTIN 16
#define SENSOR 2

long currentMillis = 0;
long previousMillis = 0;
int interval = 1000;
boolean ledState = LOW;
float calibrationFactor = 4.5;
volatile byte pulseCount;
byte pulse1Sec = 0;
float flowRate;
unsigned long flowMilliLitres;
unsigned int totalMilliLitres;
float flowLitres;
float totalLitres;

void IRAM_ATTR pulseCounter()
```

```
{  
    pulseCount++;  
}  
  
WiFiClient client;  
  
void setup()  
{  
    Serial.begin(115200);  
    display.begin(SSD1306_SWITCHCAPVCC, 0x3C); //initialize with  
    display.clearDisplay();  
    delay(10);  
  
    pinMode(LED_BUILTIN, OUTPUT);  
    pinMode(SENSOR, INPUT_PULLUP);  
  
    pulseCount = 0;  
    flowRate = 0.0;  
    flowMilliLitres = 0;  
    totalMilliLitres = 0;  
    previousMillis = 0;  
  
    attachInterrupt(digitalPinToInterrupt(SENSOR), pulseCounter,  
}  
  
void loop()  
{  
    currentMillis = millis();  
    if (currentMillis - previousMillis > interval)  
    {  
  
        pulse1Sec = pulseCount;  
        pulseCount = 0;  
  
        // Because this loop may not complete in exactly 1 second  
        // the number of milliseconds that have passed since the last  
        // tick to scale the output. We also apply the calibration  
        // based on the number of pulses per second per units of millilitres  
        // (in this case) coming from the sensor.  
        flowRate = ((1000.0 / (millis() - previousMillis)) * pulse1Sec);  
        previousMillis = millis();  
  
        // Divide the flow rate in litres/minute by 60 to determine  
        // how many litres have been passed through the sensor in this 1 second interval, th
```

```
// convert to millilitres.  
flowMilliLitres = (flowRate / 60) * 1000;  
flowLitres = (flowRate / 60);  
  
// Add the millilitres passed in this second to the cumulative total  
totalMilliLitres += flowMilliLitres;  
totalLitres += flowLitres;  
  
// Print the flow rate for this second in litres / minute  
Serial.print("Flow rate: ");  
Serial.print(float(flowRate)); // Print the integer part  
Serial.print("L/min");  
Serial.print("\t"); // Print tab space  
  
display.clearDisplay();  
  
display.setCursor(10,0); //oled display  
display.setTextSize(1);  
display.setTextColor(WHITE);  
display.print("Water Flow Meter");  
  
display.setCursor(0,20); //oled display  
display.setTextSize(2);  
display.setTextColor(WHITE);  
display.print("R:");  
display.print(float(flowRate));  
display.setCursor(100,28); //oled display  
display.setTextSize(1);  
display.print("L/M");  
  
// Print the cumulative total of litres flowed since start  
Serial.print("Output Liquid Quantity: ");  
Serial.print(totalMilliLitres);  
Serial.print("mL / ");  
Serial.print(totalLitres);  
Serial.println("L");  
  
display.setCursor(0,45); //oled display  
display.setTextSize(2);  
display.setTextColor(WHITE);  
display.print("V:");  
display.print(totalLitres);  
display.setCursor(100,53); //oled display  
display.setTextSize(1);
```

```
display.print("L");
display.display();
}

if (client.connect(server, 80)) // "184.106.153.149" or api.
{
    String postStr = apiKey;
    postStr += "&field1=";
    postStr += String(float(flowRate));
    postStr += "&field2=";
    postStr += String(totalLitres);
    postStr += "\r\n\r\n";

    client.print("POST /update HTTP/1.1\n");
    client.print("Host: api.thingspeak.com\n");
    client.print("Connection: close\n");
    client.print("X-THINGSPEAKAPIKEY: " + apiKey + "\n");
    client.print("Content-Type: application/x-www-form-urlencoded");
    client.print("Content-Length: ");
    client.print(postStr.length());
    client.print("\n\n");
    client.print(postStr);

}
client.stop();
}
```

Monitoring Water Flow Rate & Volume

Once the Code is uploaded the OLED Display will start working and will show the flow rate and volume. Initially the flow rate will be **0 liter/minute(L/M)**. Also Total Volume shown will be **0 Liter(L)**.

Once the motor is turned ON & Water Starts flowing, you can see the OLED Display displaying the **Flow Rate (F) & Volume(V)**.

Now you can monitor the **Water Flow Rate & Volume** Data on **Thingspeak Server** as well. You just need to visit the Private View of Thingspeak Dashboard.

Video Tutorial & Complete Guide

IoT Water Flow Meter using NodeMCU ESP8266 & Water Flow Sensor

I Measure Water Flow Rate & Volume

Watch this video [on YouTube](#).

44 Comments



asxhasx

August 18, 2020 at 10:27 AM

where is the code?

Loading...

Reply



Mr. Alam

August 18, 2020 at 7:43 PM

The Code is already given. Check above

Loading...

Reply

Fabio

August 26, 2020 at 3:17 PM

Hello everyone. When i'm try to upload de code give me error.

Arduino: 1.8.13 (Windows 10), Placa:"Arduino Nano, ATmega328P"

C:\Users\ClickBeauty\Desktop\sketch_aug26b\sketch_aug26b.ino:18:0
: warning: "LED_BUILTIN" redefined

```
#define LED_BUILTIN 16
```

In file included from C:\Program Files

(x86)\Arduino\hardware\arduino\avr\variants\eightanaloginputs/pins_ar
duino.h:23:0,

```
from C:\Program Files (x86)\Arduino\hardwa  
  
from sketch\sketch_aug26b.ino.cpp:1:
```

c:\program files

(x86)\arduino\hardware\arduino\avr\variants\standard\pins_arduino.h:5
4:0: note: this is the location of the previous definition

```
#define LED_BUILTIN 13
```

sketch_aug26b:34:16: error: expected initializer before 'pulseCounter'

void IRAM_ATTR pulseCounter()

sketch_aug26b:34:16: error: expected initializer before 'pulseCounter'

void IRAM_ATTR pulseCounter()

C:\Users\ClickBeauty\Desktop\sketch_aug26b\sketch_aug26b.ino: In
function 'void setup()':

sketch_aug26b:57:50: error: 'pulseCounter' was not declared in this
scope

attachInterrupt(digitalPinToInterrupt(SENSOR), pulseCounter,
FALLING);

C:\Users\ClickBeauty\Desktop\sketch_aug26b\sketch_aug26b.ino:57:5
0: note: suggested alternative: 'pulseCount'

```
attachInterrupt(digitalPinToInterrupt(SENSOR), pulseCounter,  
FALLING);
```



pulseCour

exit status 1
expected initializer before 'pulseCounter'
can any one help me? i'm a beginner on this.
thanks

Loading...

Reply

guruvaraja

September 13, 2020 at 10:46 PM

Excellent article written by the author easily understandable .
project working correctly after uploading the given code and API key.
Very good performance of my flow sensor by blowing into it serial
monitor display the values as expected
But my OLED not display anything
Any troubleshooting ?

Loading...

Reply

Mr. Alam

September 13, 2020 at 10:49 PM

Check the SDA & SCL connection of OLED with Nodemcu board.
Also check the I2C Address of the OLED Display.
Some oled have different I2C address than 0x3C. Try check by
changing the I2C address in Code.

Loading...

Reply

Prosper Magara**October 14, 2020 at 5:49 PM**

Hello, in void setup, you forgot to include "WiFi.begin(ssid,pass);". is it supposed to work as it is or you made an omission

Loading...

Reply

Mr. Alam**October 14, 2020 at 5:52 PM**

Yes, you need this under the setup function. Thanks, I will modify the code

Loading...

Reply

Ivan Labrador**October 25, 2020 at 11:00 PM**

Hello, excellent project, I have learned a lot with it. I have a question, I have done exactly the same, but I see that on some occasions the esp8266 freezes (and strange characters start to appear through the serial monitor) and I see that it works again when I disconnect the flow sensor, and being connected to it and it works perfectly. Do you have any idea why this can happen?

Loading...

Reply

**laguna**

November 3, 2020 at 1:21 PM

Hello, I have tried and it works, thank you @ Mr Alam. Next step is to save water flow and volume data in real time to google sheet, is it programmed from nodemcu or from thingspeak?

Loading...

Reply

**Mr. Alam**

November 3, 2020 at 2:01 PM

You can export the logged data from Thinspeak Dashboard. The data is recorded and saved there which can be exported to excel.

Loading...

Reply

**Joha Oosthuizen**

November 24, 2020 at 12:55 AM

Hi there

Love this tutorial!

Please can you create code for Blynk application.I would like this exact setup but to work with Blynk server. Please!!

Thanks in advance.

Loading...

Reply

Alfred Cuenca

December 2, 2020 at 6:47 PM

Me podrias ayudar, porque la thingspeak no me toma los datos

Loading...

Reply

Bob

December 16, 2020 at 7:23 PM

Not sure what Im doing wrong, I copy and paste the entire code into Arduino IDE and verify. I keep getting this message:

Arduino: 1.8.12 (Windows 10), Board: "NodeMCU 1.0 (ESP-12E Module), 80 MHz, 115200, 4M (3M SPIFFS)"

TST1:34:16: error: expected initializer before 'pulseCounter'

```
void IRAM_ATTR pulseCounter()
```

A

TST1:34:16: error: expected initializer before 'pulseCounter'

```
void IRAM_ATTR pulseCounter()
```

A

C:\Users\abc\Documents\Arduino\TST1\TST1.ino: In function 'void setup()':

TST1:57:50: error: 'pulseCounter' was not declared in this scope
attachInterrupt(digitalPinToInterrupt(SENSOR), pulseCounter,
FALLING);

A

exit status 1

expected initializer before 'pulseCounter'

Loading...

Reply

**Bob**

December 16, 2020 at 7:58 PM

Did you find a solution for this? I am also getting this error.

Loading...

Reply

**mubarak-kankara**

January 23, 2021 at 12:19 PM

expected initializer before 'pulseCounter' is there solution for this
please someone should help thanks

Loading...

Reply

**Shreyansh Shrey**

March 22, 2021 at 11:02 AM

please use #define SENSOR D2 instead of #define SENSOR 2

Loading...

Reply

**Mr. Alam**

March 22, 2021 at 11:34 AM

D2 is GPIO4. So instead of D2 use 4 like:

#define SENSOR 4

Loading...

Reply

Kheokchin Ong[March 27, 2021 at 6:18 AM](#)

The specification of YF-S201 shows Output type is 5V TTL and you connect directly to GPIO2 port which is only 3.3V. Will that cause any problem, error or even destroy the ESP8266 ?

Loading...

Reply

Mr. Alam[March 27, 2021 at 10:30 AM](#)

There is an internal voltage divider network in ESP8266. So no issues.

Loading...

Reply

Mr.MS[April 11, 2021 at 8:06 PM](#)

Hi, I am using this code but I can see some times the flowrate goes above 50-55L/min, but how is it possible?
The module itself only supports 1-30L/min floRate only.

Loading...

Reply

Bhuvi[April 13, 2021 at 11:36 AM](#)

yes same error for me also.. can anyone clearup?

Loading...

Reply

April 15, 2021 at 3:14 PM

Hello what happen on my code??

```
void IRAM_ATTR pulseCounter()
```

Loading...

Reply

Rakshana Priya S

April 24, 2021 at 9:58 PM

thanku so much!! it helped me a lot!! but I got the flow rate and volume displayed in my oled but it is not properly displayed in my serial monitor,something like question marks,boxes and random letters.. and thereby not in my thinkspeak channel as well.. could u PLZ help me with that ...

Loading...

Reply

Alex Newton

April 24, 2021 at 10:10 PM

Please check the baudrate for Serial monitor part.

And to solve thingspeak issue add some delay between the different commands for thingspeak.

Loading...

Reply

Rakshana Priya S[April 25, 2021 at 8:13 PM](#)

Thank you for the reply sir!! I have checked the baud rate changed it multiple times and yet no change!! Also its not visible in the thingspeak server as well.just to clarify, api key is the one which connects with the thinkgseek server and there is no mention of channel id in the code right?

Loading...

Reply

Akshay[April 26, 2021 at 9:49 PM](#)

hello @Mr Alam I am working with a project related to same topic, could you help me to clarify with my doubts? if yes could you provide me your mail id for communication. Or if u feel uncomfortable to disclose your mail id, please do contact me through – jakshay11992@gmail.com.

Loading...

Reply

**Milan Váňa**

May 7, 2021 at 1:34 PM

Perfect processing, functional on first start-up, but data is reset after power off. Advise how to keep data in ESP 32 memory?

Loading...

Reply

**Alex Newton**

May 7, 2021 at 1:43 PM

Store in the rtc memory or eeprom

Loading...

Reply

**Milan Váňa**

May 7, 2021 at 1:53 PM

I use NODEMCU, not everyone saves data? Did you manage the code?

Loading...

Reply

**Wafae Tamasna**

May 26, 2021 at 2:57 PM

Hello please when I compile the code it gives me error that client was not declared in this scope if could you help me sir

Loading...

Reply

**harsha**

[June 8, 2021 at 10:27 AM](#)

i done with code and works fine but wifi was not connecting to nodemcu will u please help me

Loading...

[Reply](#)

**harsha**

[June 8, 2021 at 4:10 PM](#)

I need a Help, My board is not connecting with WIFI . i tried with other new board too not connecting to WIFI help me out on this issue.

Loading...

[Reply](#)

**Mike804**

[October 29, 2021 at 8:34 PM](#)

Could post code for MQTT?

Thanks

Loading...

[Reply](#)



Pedro

January 7, 2022 at 1:45 AM

Hello

Everithing is just working fine but i never was able to connect with thingspeak, the wifi of the board is ok and I already add a delay of 15 seconds. Also to try to resolved this I included tge thingspeak library but even with this changes I not able to connect with thingspeak. Can you please help me? Thank you for all the projects that and especiaaly for this one.

Loading...

Reply



ressamendy

April 29, 2022 at 2:17 AM

Hello. I installed chirpstack lorawan server. I want to send the water measurement to this server. Is there a chance to combine your two projects that I have given the web link below? So we will measure liters of water with nodemcu and flowmeter. Then with lora, we will send it to chirpstack over the 2 channel lora gateway you made with esp32.

Project link: https://how2electronics.com/iot-water-flow-meter-using-esp8266-water-flow-sensor/#Mathematical_Calculation_to_Measure_Flow_Rate_Volume

Project link: <https://how2electronics.com/lora-based-soil-moisture-monitoring-on-lora-esp32-webserver/>

Loading...

Reply

 **habil said**

May 21, 2022 at 4:02 AM

hello how can i know my wifi ssid and password that am supposed to change it in the code
please help

Loading...

Reply

 **Dilbag Singh**

May 27, 2022 at 2:28 PM

Hi Sir,
I want output on my own application instead of thingspeak.
Please tell me how I can do this?
Thanks

Loading...

Reply

 **Captain Jacky**

June 15, 2022 at 8:04 PM

Hi, your wifi ssid and password probably is going to be on your wifi router. Please check it.

Loading...

Reply

Captain Jacky

June 15, 2022 at 8:05 PM

Hi, check your ssid and password. Also, try to restart your router. 😊
Cheers.

Loading...

Reply

Captain Jacky

June 15, 2022 at 8:07 PM

Hi, are you using the same version of the water flow sensor? Probably you need to calibrate your sensor and formulas a bit. Maybe your water sensor is not in the correct position or damaged? Cheers.

Loading...

Reply

ruchir

June 16, 2022 at 12:30 PM

hello sir. i like your project. i want to add buzzer for low flow rate or pump not run dry. so plzz send code
thank u very much

Loading...

Reply

john creighton

July 7, 2022 at 2:37 AM

hi, could you PLEASE address the issue that multiple people have mentioned above, that the sketch will not compile and this error occurs:

error: expected initializer before 'pulseCounter'

```
void IRAM_ATTR pulseCounter()
```

there is then another error related to this one [In function 'void setup()':

```
water_flow:82:50: error: 'pulseCounter' was not declared in this scope  
attachInterrupt(digitalPinToInterrupt(SENSOR), pulseCounter,  
FALLING); ]
```

PLEASE help with a solution to this.

thank you

Loading...

Reply

SHLD

July 26, 2022 at 11:53 PM

This code is specific to the ESP8266. Simply remove IRAM_ATTR

Loading...

Reply

bhavik

September 18, 2022 at 6:27 AM

i guess you need to calibrate sensor

Loading...

Reply