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Q Search

+ Project (/publish/project) BorisDmitrenko

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(/projects)

Contests
(/contests)

GPS module Interfacing with PIC18F4550

Overview of GPS

Global Positioning System (GPS) makes use of signals sent by satellites in space and ground stations on Earth to accurately determine their position on Earth.

Radio Frequency signals sent from satellites and ground stations are received by the GPS. GPS makes use of these signals to determine its exact position.

The GPS itself does not need to transmit any information.

The signals received from the satellites and ground stations contain timestamps of the time when the signals were transmitted. By calculating the time difference between the time the signal was transmitted and the time the signal was received, and using the speed of the signal, the distance between the satellites and the GPS can be determined using a simple formula for distance using speed and time.

Using information from 3 or more satellites, the exact position of the GPS can be triangulated.

For more information about GPS and how to use it, refer to the topic GPS Receiver Module (http://electronicwings.com/sensors-modules/gps-receiver-module) in the sensors and modules section.
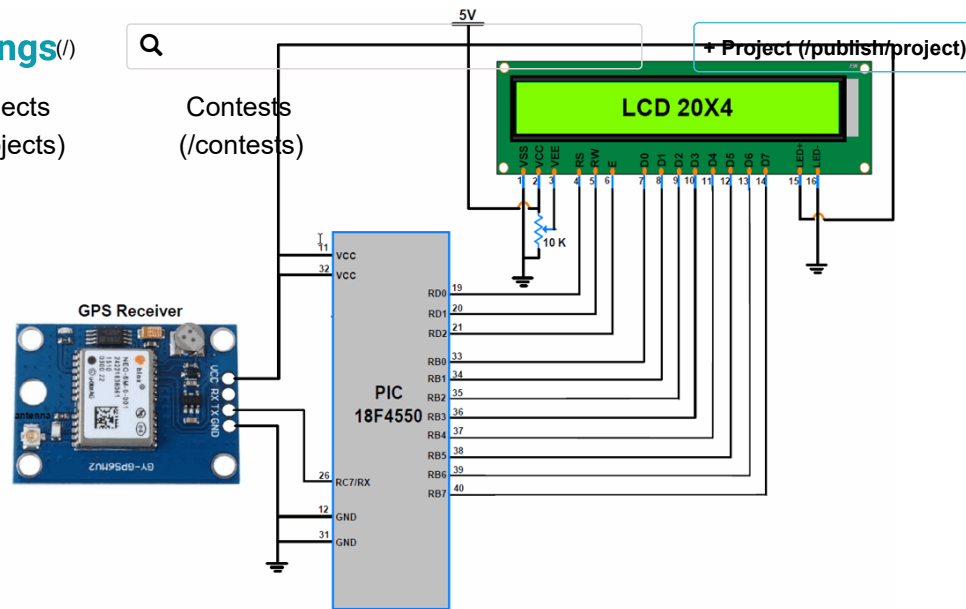
The GPS receiver module uses USART communication to communicate with the controller or PC terminal.

For information about USART in PIC18F4550 and how to use it, refer to the topic USART in PIC18F4550 (http://electronicwings.com/pic/pic18f4550-usart) in the PIC inside section.

GPS Receiver Module

Connection Diagram GPS to PIC18F4550

GPS Receiver Interfacing with PIC18F4550

Get Lat, Long, Alt, and UTC using PIC18F4550

Now let's interface the GPS receiver module with PIC18F4550 and display the Time, Latitude, Longitude, and Altitude on the LCD20x4 display.

In this interfacing, the PIC18F4550 microcontroller will read data serially from the GPS receiver using USART communication with a 9600 Baud rate.

Then parse the "$GPGGA" string to extract information regarding time, latitude, longitude, and altitude.

GPS Code for PIC18F4550

```
/*
    GPS Information extraction using PIC18F4550
    http://www.electronicwings.com
*/

#include<pic18f4550.h>
#include<string.h>
#include<stdio.h>
#include<stdlib.h>
#include "Configuration_Header_File.h"
#include "LCD_20x4_H_file.h"
#include "USART_Header_File.h"

unsigned long int get_gpstime();
float get_latitude(unsigned char);
float get_longitude(unsigned char);
float get_altitude(unsigned char);
void convert_time_to_UTC(unsigned long int);
float convert_to_degrees(float);

#define GGA_Buffer_Size 80
```

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(/explore)

Projects
(/projects)

Contests
(/contests)

+ Project (/publish/project)

How to Calculate Latitude and Longitude in GPS coordinates form

We get Latitude and Longitude from GGA string which is in the form of **ddmm.mmmm** and **dddmm.mmmm** respectively.

Where,

D – degree

M – minutes

Now, we can convert received latitude and longitude string in DMS (Degree Minute Second) and Degree Decimal.

DMS – [dd] degree, [mm] minutes, [(.mmmm)*60] seconds

Degree Decimal– [dd] degree + (mm.mmmm/60)

E.g. We have the following Lat/Long data in NMEA format

Latitude – 1829.9639

Longitude – 07347.6174

Now, convert them in the following format –

DMS – 18° degree 29 minutes 57.834 seconds

Degree - 18.499398

Video of GPS Communication with PIC18F4550

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(/explore)

Projects
(/projects)

Contests
(/contests)

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Components Used

Powered By

Ublox NEO-6m GPS
Ublox Neo 6m GPS

X 1

🛒 (https://www.mouser.i
n/ProductDetail/u-
blox/NEO-6M-0?
qs=%2Fha2pyFadugkaj
Kt09R%252B2kPqlwSc
DfLUoclwLfrvM5s%3D
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neo-6m-
gps/1/datas
heet)

LCD16x2 Display
LCD16x2 Display

X 1

🛒 (https://www.mouser.c
om/ProductDetail/Ada
fruit/1447?
qs=XAKIUOoRPe6ACl
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Components Used

Powered By

PIC18f4550
PIC18f4550

X 1

🛒 (https://www.mouser.in/ProductDetail/Microchip-Technology/PIC18F4550-I-P?qs=oKK8NaWdAJs8nLDXBGwMXw%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

📄 Datasheet (/components/pic18f4550/1/datasheet)

PICKit 4 MPLAB
PICKit 4 MPLAB

X 1

🛒 (https://www.mouser.in/ProductDetail/Microchip-Technology/PG164140?qs=r5DSvlrkXmLKDuYNJlmLWw%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

📄 Datasheet (/components/pickit-4-mplab/1/datasheet)

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(/explore)

Projects
(/projects)

Contests
(/contests)

PIC18F4550 Interface with GPS Project File

Dow (/api/download/platf
nloa orm-attachment/328)
d

GPS Basics

Dow (/api/download/platf
nloa orm-attachment/329)
d

NMEA Reference Manual

Dow (/api/download/platf
nloa orm-attachment/330)
d

Comments

Comment

lsteward
(/users/lsteward/profile)
2018-03-16 15:57:36

I have used many of your circuits with no issue. They are concise, accurate and well documented. However I do have an issue with the GPS module Interfacing with PIC18F4550. I plan to use the GPS module as part of my project to guide an AGV car. Here is my issue. The Latitude calculated in your code is inaccurate and I cannot resolve the issue. In my current GPS location I verified that the Latitude coordinate should be 43.03993 but the software is calculating 43.04199. First of all I am using the documented circuit and XC8 code in your article, including the same GPS module you used. The NMEA code should 4302.3999 which should give me Lat 43.0399. Longitude does not appear to be an issue.

I also ran an NMEA list from the same module with an arduino Mega and the average Lat code was 4302.3994 and this equates to my actual Lat coordinate. I also duplicated this testing with a different GPS module (same model) with the same result. I have to assume that your project would pull from the same NMEA data - so why is there a discrepancy?

I also did some checking on the NMEA Latitude code in your code which appeared to be close to 4302.4370 and this does not even equate to 43.04199 on the LCD display. I have also tried troubleshooting using your code in a c program and the results indicate that your xc8 code is not operating as the c program - anyway this is not an ideal testing. Just to confirm that I do not move locations in my testing.

In my calculation the displayed Latitude coordinate is approximately 1200 from the correct one. As I said Longitude doesn't appear to be a problem.

Can you help to resolve this issue because it would make my project unworkable. By the way I also reached out on another issue in February and received an email saying that ElectronicWings would get back to me, no one ever did get back to me.

Please help me or suggest another way to resolve this. Please don't leave me hanging.

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(/explore)

Projects
(/projects)

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Ian Steward
Email: Ian.steward@comcast.net
Home Phone: 603-384-1219
Cell Phone: 603-686-9413
Located in New Hampshire, USA
Reply   Like   1 👍

lokeshc
(/users/lokeshc/profile)
2018-03-17 09:56:52

Hello Ian,
I made some changes in above program so you can use it. The changes are minor regarding float, double and int conversions. Also use Pole(North, South, East, West) information to convert latitude and longitude into degrees.
Check this program with your GPS module hope it will work. And, if doesn't work then let me know.
I found that PIC microcontroller not giving accurate float value beyond 3 places after a decimal.
But, if you find anything regarding float value or any mistake in a new program then also let me know.
Reply   Like

Isteward
(/users/Isteward/profile)
2018-03-21 12:13:31

Hello

Thank you for quick response. I looked into your changes. There was no change in result with Latitude. The changes made Longitude inaccurate - it was accurate before the change.

At first I suspected that the raw NMEA data was not being read correctly but I confirmed that it was ok. So I determined that the issue was the atof function. An input of char 4302.39450 gave an incorrect output result of float 4302.4730 and the convertion from raw to degrees probably added a little more error but not much.

I have tried a number of alternatives to atof but could not make any of them compile in xc8. Let me know if you can recommend any code alternatives to give me the correct answers.

Again thank you for help on this and the time you have spent on it.

Ian
Reply   Like

Isteward
(/users/Isteward/profile)
2018-03-23 17:27:41

I have tried without success to get the software to reflect accurately from the raw NMEA data. Can you offer any code alternatives to make this work?
Thanks

Ian
Reply   Like

Isteward
(/users/Isteward/profile)
2018-03-31 15:30:10

I was hoping for a response to my last two messages. It is very disappointing that I can get no corrections to the gps code you supplied. Please advise that you will no longer provide assistance with this. It is very disappointing that you leave me without an

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answer.
(/)

Please advise.

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Ian Steward

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lsteward
(/users/lsteward/profile)
2018-04-18 07:01:08

⋮

Hello Lokeshc
I was able to get the correct accuracy by going to 32 bits via xc8 linker settings.
Thanks for your help on this.

I now have another question regarding the GPS project. I have been trying for a month
now to configure your GPS project to include your Magnetometer project code so that
I can access GPS data and Heading Data on the single pic18f4550. I think it involves
Usart and turning off and on the interrupt flags but so far I have been unable to
successfully have them coexist. Can you give me some guidance on doing this. I can
send you my code if you wish. Please let me know if you could help because I have had
expanded a great deal of time on this. Thank you.

Reply   Like

lsteward
(/users/lsteward/profile)
2018-04-20 16:26:10

⋮

Can someone please respond to my last question. Usually I get an automated email
when I ask a question but not this time. Can you respond please?
Ian

Reply   Like

lokeshc
(/users/lokeshc/profile)
2018-04-24 23:10:53

⋮

Ian Steward
Hey Ian, I want to know how you did the 32-bit xc8 linker settings.
you can use mpu6050 and GPS combined. While accessing mpu6050 data you
can disable interrupt and re-enable it after reading data. To do this, you can
search on google.

Reply   Like

lsteward
(/users/lsteward/profile)
2018-04-26 06:29:08

⋮

You can correct the accuracy by setting the following project configuration.

Project Properties -> XC8 Global options -> XC8 linker -> Options categories ->
Memory model -> set float and double to 32 bits.

Reply   Like   1 👍

lokeshc
(/users/lokeshc/profile)
2018-04-26 20:54:35

⋮

Cool!!! I will try it.
Ty in advance.

Reply   Like

chapelenterprises52
(/users/chapelenterprises52/profile)
2018-08-17 12:30:44

⋮

Hi, I had the same problem with accuracy when trying to convert to British
National Grid (complicated maths). The fault is in the float definition.

"So, for example, if you are using a 24-bit wide floating-point type, it can exactly

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Platforms
(/explore)

Projects
(/projects)

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store
the value 95000.0. However, the next highest number it can represent is 95002.0 and
it is impossible to represent any value in between these two in such a type as it will be
rounded. "

Full info in the XC8 manual Section 5.4.3 pages 147/8

Even after setting float and double to 32 bits, it was causing 100m inaccuracy in the conversion. Only option is to step up the processor range.

Reply   Like   1 👍

siv12345
(/users/siv12345/profile)
2018-05-06 02:18:13

Sir, need PIC18F4550 gps speed monitoring code. please send to my mail id sivaeshwaran@gmail.com,
this gps module is very great to monitor high accuracy location.
Reply   Like

lokeshc
(/users/lokeshc/profile)
2018-05-06 02:33:49

You can extract speed information from NMEA 'RMC' and 'VTG' string. It is same as extracting latitude, longitude from gga string.
Reply   Like

Robert
(/users/Robert/profile)
2018-07-10 18:17:49

Hello Lokeshc,
You mentioned " changes are minor regarding float, double and int conversions. ". Would you please send me updated code? Thank you.
roberttku5178@gmail.com
Reply   Like

Robert
(/users/Robert/profile)
2018-07-10 18:58:50

Hello Lokeshc,
I followed your code, but can't see any output on LCD. Would you please teach me, why?
Robert
Reply   Like

lokeshc
(/users/lokeshc/profile)
2018-07-10 22:44:22

there may be lots of reasons for not getting any output.
check connections properly.
did you use that code for lcd20x4 or lcd16x2? debug the code by displaying some test character on LCD which will help you to find any error if any?
Reply   Like

egondoidao
(/users/egondoidao/profile)
2018-12-03 11:16:43

Hello there! Awesome project lokeshc!
I'm wondering, is it possible to use a 16x2 display instead? It shouldn't be too hard to adapt right?
Reply   Like

lokeshc

EW ElectronicWings

(/) 2018-12-03 06:39:09

yes, it is possible to use LCD 16x2. But, LCD 20x4 is also not so different than
LCD 16x2.

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blarblublublar

(/users/blarblublublar/profile)
2019-05-30 21:35:29

Latitude = get_latitude(GGA_Pointers[0]);
Longitude = get_longitude(GGA_Pointers[2]);
Altitude = get_altitude(GGA_Pointers[7]);

Hello I think GGA_Pointers index shoulde be
Latitude = get_latitude(GGA_Pointers[1]);
Longitude = get_longitude(GGA_Pointers[3]);
Altitude = get_altitude(GGA_Pointers[8]);
Am i Right?
Reply   Like

NguyenTri

(/users/NguyenTri/profile)
2020-12-16 13:53:48

In Interrupt Service Routine function you clear GIE bit (global interrupt) to disable
USART interrupt, this case also to disable all other interrupts. How to write a program
with more than one interrupt function and they run independently.
Reply   Like

DmitrijDmitrij

(/users/DmitrijDmitrij/profile)
2020-12-26 18:16:24 • Edited

Thanks for the description!
I built a GPS Tracker, Link:
https://pic-projekte.de/forum/viewtopic.php?f=4&t=143
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igshid=1cip10jijttko)

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