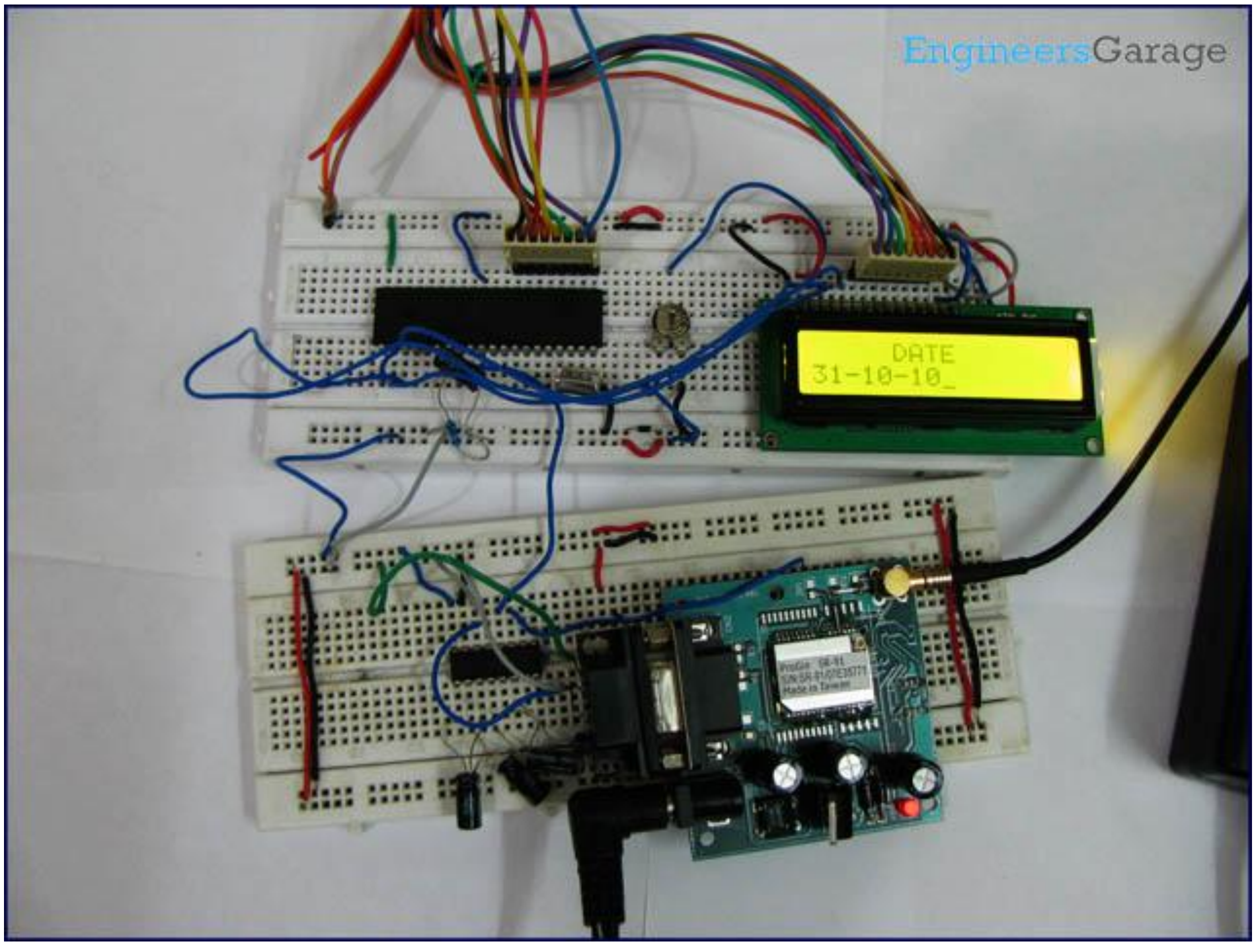
How to extract details from GPS Receiver using 8051 Microcontroller



The GPS module continuously transmits serial data (RS232 protocol) in the form of sentences according to NMEA standards. The latitude, longitude, time, date and speed values of the receiver are contained in the **GPRMC** sentence as given in the following example (also refer NMEA format for other sentences). In this project, these values are extracted from the GPRMC sentence and are displayed on LCD.

Example : $GPRMC,132455.970,A,2651.0145,N,07547.7051,E,0.50,342.76,301010,,,A*64

where:

RMC	Recommended Minimum sentence C
132455.970	Fix taken at 13:24:55.970 UTC
A	Status A=Active or V=Void.

2651.0145, N	Latitude 26 deg 51.0145' N
07547.7051, E	Longitude 075 deg 47.7051' E
0.50	Speed over the ground in knots
342.76	Track angle in degrees True
301010	Date : 30th of October 2010
Empty field (xxx.x, y)	Magnetic Variation
*64	The checksum data, always begins with *

The serial data is taken from the GPS module through MAX232 into the SBUF register of 8051 controller (refer serial interfacing with 8051). The serial data from the GPS receiver is taken by using the Serial Interrupt of the controller. This data consists of a sequence of NMEA sentences from which GPRMC sentence is identified and processed.

The extraction of required values is done as follows. The first six bytes of the data received are compared with the pre-stored ($GPRMC) string and if matched then only data is further accounted for; otherwise the process is repeated again. From the comma delimited GPRMC sentence, latitude, longitude, date, time, speed values are extracted by finding the respective comma positions. The values thus extracted are displayed on the LCD interfaced with AT89C51.

The circuit connections are as follows:

Receiver1 (R_1) of MAX232 has been used for the serial communication. The receiver pin of GPS module is connected to R_1IN (pin13) of MAX232. R_1OUT (pin 12) of MAX232 is connected to RxD (P3.0) of AT89C51.

Pins 1-3 of port P1 (P1.0, P1.1 & P1.2 respectively) of AT89C51 are connected to the control pins (RS, R/W& EN) of LCD. The data pins of LCD are connected to Port P2 of the controller. The latitude and longitude positions are displayed on the LCD.

```
/* Program to display time date,latitude,longitude,speed on LCD by
extracting the GPRMC statement sent by GPS receiver*/
#include<reg51.h>
#define port2 P2
sbit rs = P1^0;
sbit rw = P1^1;
sbit e = P1^2;
```

```
char info[70];
char test[6]={"$GPRMC"};
char comma_position[13];
unsigned int check=0,i;
unsigned char a;
void receive_data();
void lcd_time();
void lcd_latitude();
void lcd_longitude();
void lcd_speed();
void lcd_date();

//DELAY FUNCTION
void delay(unsigned int msec)
{
    int i,j ;
    for(i=0;i<msec;i++)
    for(j=0;j<1275;j++);
}

// LCD COMMAND SENDING FUNCTION
void lcd_cmd(unsigned char item)
{
    port2 = item;
    rs= 0;
    rw=0;
    e=1;
    delay(1);
    e=0;
    return;
}

// LCD DATA SENDING FUNCTION
void lcd_data(unsigned char item)
{
    port2 = item;
    rs= 1;
    rw=0;
    e=1;
    delay(1);
    e=0;
    return;
}

 // LCD STRING SENDING FUNCTION
void lcd_string(unsigned char *str)
```

```
{
    int i=0;
    while(str[i]!='\0')
    {
        lcd_data(str[i]);
        i++;
        delay(10);
    }
    return;
}

// SERIAL PORT SETTING
void serial()
{
    TMOD=0x20;    //MODE=2
    TH1=0xfa;      // 4800 BAUD
    SCON=0x50  ;  // SERIAL MODE 1 ,8- BIT DATA ,1 STOP BIT ,1 START BIT , RECEIVING ON
    TR1=1;          //TIMER START
}

void find_comma()
{
    unsigned int i,count=0;
    for(i=0;i<70;i++)
    {
        if(info[i]==',')
        {
            comma_position[count++]=i;
        }
    }
}
void compare()
{
    IE=0x00;
    find_comma();
    lcd_time();
    lcd_date();
    lcd_latitude();
    lcd_longitude();
    lcd_speed();
    check=0;
    IE=0x90;
}
```

```
void receive_data()            interrupt 4
{
    info[check++]=SBUF;      //Read SBUF
    if(check<7)
    {
        if(info[check-1]!=test[check-1])
        check=0;
    }
    RI=0;
}
void lcd_time()
{
    unsigned int c1=comma_position[0];
    lcd_cmd(0x01);                 //Clear LCD display
    lcd_data(comma_position[0]);
    delay(50);
    lcd_cmd(0x01);                //Clear LCD display
    lcd_cmd(0x86);               //Move cursor to position 6 of line 1
    lcd_string("TIME");            //Showing time
    lcd_cmd(0xC0);                //Begining of second line
    lcd_data(info[c1+1]);        //Displaying hours
    lcd_data(info[c1+2]);
    lcd_string(":");
    lcd_data(info[c1+3]);        //Displaying minutes
    lcd_data(info[c1+4]);
    lcd_string(":");
    lcd_data(info[c1+5]);        //Displaying seconds
    lcd_data(info[c1+6]);
    lcd_data(info[c1+8]);
    lcd_data(info[c1+9]);
    lcd_data(info[c1+10]);
    delay(250);                    //Delay, so one can see time
}

void lcd_shape()                //Shape of degree symbol
{
    lcd_cmd(64);
    lcd_data(10);
    lcd_data(17);
    lcd_data(17);
    lcd_data(10);
    lcd_data(0);
    lcd_data(0);
    lcd_data(0);
    lcd_data(0);
}
```

```
void lcd_latitude()
{
    unsigned int c3=comma_position[2];
    lcd_shape();
    lcd_cmd(0x01);                  //Clear LCD display
    lcd_cmd(0x84);                //Move cursor to position 6 of line 1
    lcd_string("LATITUDE");         //Showing latitude
    lcd_cmd(0xC0);                  //Begining of second line
    lcd_data(info[c3+1]);
    lcd_data(info[c3+2]);
    lcd_data(0);
    lcd_data(info[c3+3]);
    lcd_data(info[c3+4]);
    lcd_data(info[c3+5]);
    lcd_data(info[c3+6]);
    lcd_data(info[c3+7]);
    lcd_data(info[c3+8]);
    lcd_data(info[c3+9]);
    lcd_data(0x27);             //ASCII of minute sign(')
    lcd_data(info[c3+10]);
    lcd_data(info[c3+11]);
    delay(250);
}

void lcd_longitude()
{
    unsigned int c5=comma_position[4];
    lcd_cmd(0x01);                  //Clear LCD display
    lcd_cmd(0x84);                //Move cursor to position 4 of line 1
    lcd_string("LONGITUDE");         //Showing longitude
    lcd_cmd(0xC0);                  //Beginning of second line
    lcd_data(info[c5+1]);
    lcd_data(info[c5+2]);
    lcd_data(info[c5+3]);
    lcd_data(0);
    lcd_data(info[c5+4]);
    lcd_data(info[c5+5]);
    lcd_data(info[c5+6]);
    lcd_data(info[c5+7]);
    lcd_data(info[c5+8]);
    lcd_data(info[c5+9]);
    lcd_data(info[c5+10]);
    lcd_data(0x27);               //ASCII of minute sign(')
    lcd_data(info[c5+11]);
    lcd_data(info[c5+12]);
    delay(250);
}

void lcd_speed()
{
    unsigned int c6=comma_position[6], c7=comma_position[7];
    lcd_cmd(0x01);                          //Clear LCD display
    lcd_cmd(0x80);                //Move cursor to position 5 of line 1
    lcd_string("SPEED(inKNOTS)");        //Showing longitude
    lcd_cmd(0xC0);                         //Begining of second line
    for(i=c6+1;i<c7;i++)
    {
        lcd_data(info[i]);
    }
    lcd_string("KNOTS");
    delay(250);
}

void lcd_date()
{
    unsigned int c9=comma_position[8];
    lcd_cmd(0x01);              //Clear LCD display
    lcd_cmd(0x85);              //Move cursor to position 5 of line 1
    lcd_string("DATE");
    lcd_cmd(0xC0);
    lcd_data(info[c9+1]);
    lcd_data(info[c9+2]);
    lcd_data('-');
    lcd_data(info[c9+3]);
    lcd_data(info[c9+4]);
    lcd_data('-');
    lcd_data(info[c9+5]);
    lcd_data(info[c9+6]);
    delay(250);
}

void main()
{
    serial();
    lcd_cmd(0x38);        //2 LINE, 5X7 MATRIX
    lcd_cmd(0x0e);      //DISPLAY ON, CURSOR BLINKING
    IE=0x90;
    while(1)
    {
        if(check==69)
        compare();
        }
}
```