GPS Navigator

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Global positioning system (GPS) is a wonderful technology that has made navigation

Fig. 1: Author's prototype

systems highly accurate and efficient in recent years. All the mobile phones these days come with an in-built GPS receiver through which you can easily find out your current location anywhere on the earth. The only thing required is an unobstructed line-of-sight to four or more GPS satellites.

A GPS navigational device is any device that receives GPS signals and processes them to extract information for determining its exact location. Presented here is such a GPS device with a tracking record system. It shows the path traversed by you from the initial position, so you are never lost at unknown locations and can always come back to the initial point.

Circuit and working

Fig. 2 shows circuit of the GPS navigator. The circuit is built

TABLE I
NMEA Output Sentence

Option	Description
GPGGA	Time, position and fix type data
GPGSA	GPS receiver operating mode, active satellites used in the position solution, and DOP values
GPGSV	Number of GPS satellites in view, satellite ID numbers, elevation, azimuth and SNR values
GPRMC	Time, date, position, course and speed data. Recommended minimum navigation information
GPVTG	Course and speed information relative to the ground

TABLE II
Test Points

Test point	Details
TP0	0V, GND
TP1	5V
TP2	Low when S1 pressed
TP3	Train of pulses (when GPS module is connected)

around microcontroller ATmega16 (IC1), 5V voltage regulator 7805 (IC2), GPS module (connected at CON1), graphical LCD (GLCD1) and a few other components.

The circuit is powered by a 9V/12V adaptor. Regulator IC2 provides 5V regulated supply for the circuit to operate. LED1 indicates presence of power in the circuit.

Microcontroller IC1 running at a clock frequency of 16 MHz communicates with the GPS receiver modem via serial protocol. Tx pin of the GPS receiver is connected to Rx (PD0) pin of microcontroller IC1. The GPS receiver continuously transmits data at 1Hz update rate.

A 128×64-pixel, KS0108-controller-based GLCD is used to display
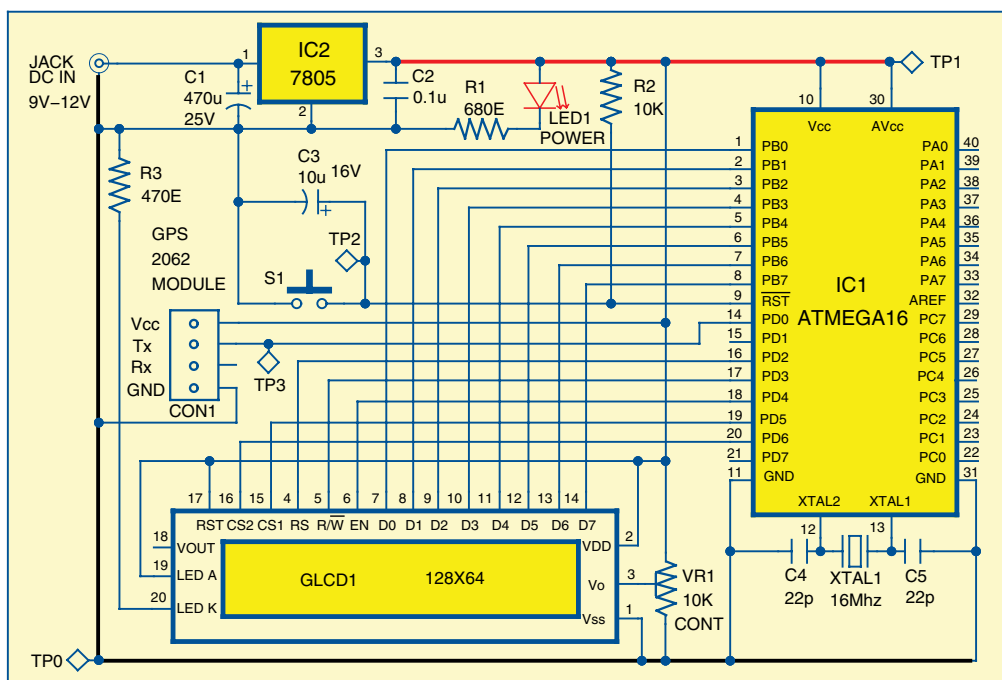

Fig. 2: Circuit of GPS Navigator

PARTS LIST

Semiconductors:

IC1   - ATmega16 microcontroller
IC2   - 7805, 5V regulator
LED1   - 5mm LED
GLCD1   - 20-pin 128×64 GLCD
               (KS0108-controller-based)

Resistors (all 1/4-watt, ±5% carbon):

R1   - 680-ohm
R2   - 10-kilo-ohm
R3   - 470-ohm
VR1   - 10-kilo-ohm preset

Capacitors:

C1   - 470µF, 25V electrolytic
C2   - 0.1µF ceramic
C3   - 10µF, 16V electrolytic
C4, C5   - 22pF ceramic

Miscellaneous:

CON1   - 4-pin connector
S1   - Tactile switch
$X_{TAL}1$ - 16MHz crystal oscillator
DC Jack   - DC jack connector
GPS   - GPS-2062 module

EFY Note

The source code of this project is included in this month's EFY DVD and is also available for free download on www.efymag.com website.

the navigation data. Port pins PB0 through PB7 of IC1 are connected to data pins D0 through D7 of GLCD1. Port pins PD2 through PD6 are used to provide control signals RS, R/$\overline{W}$, EN, CS1 and CS2 to GLCD1, respectively. Switch S1 is used to reset the navigator.

Working of the navigator is simple. Once powered on, the microcontroller stores the initial longitude and latitude data. Then it continuously plots the changing latitude and longitude as you move around (refer Fig. 1). One division change on the screen is equivalent to approximately 30 metres travelled. With the new latitude and longitude position plotted on the screen, you get a clear idea of the direction and path traveled by you. The display also shows various other information such as current latitude, longitude, speed, altitude, date, time and number of satellites the GPS modem can capture.

Software

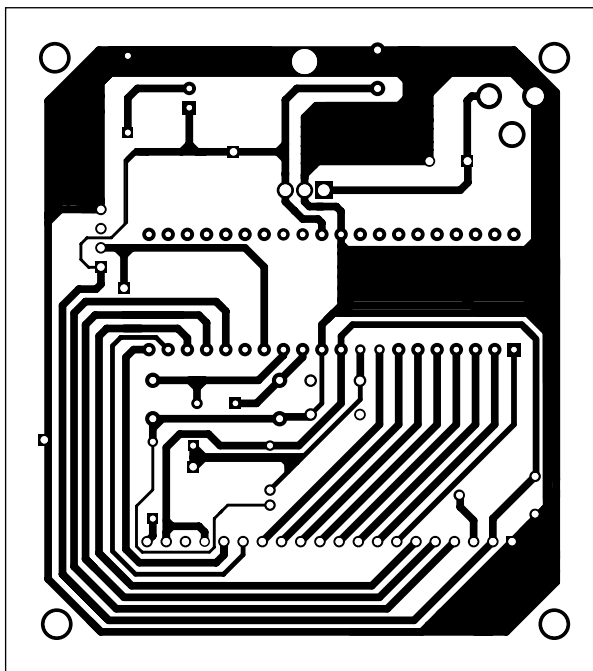The software program is written in 'C' language and compiled in WINAVR

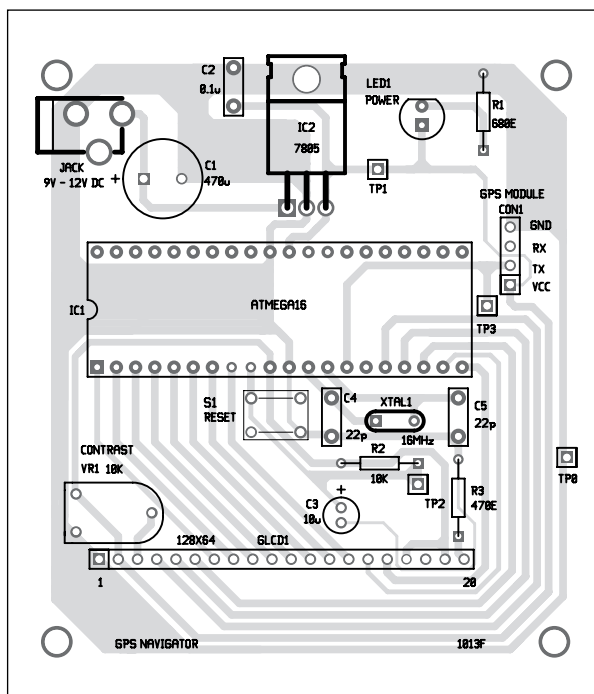Fig. 3: An actual-size, single-side PCB layout for the GPS navigator

Fig. 4: Component layout for the PCB

Programmers Notepad. WINAVR is a GCC–based compiler for AVR. Burn the program into the MCU using a suitable programmer with FUSE BYTE settings mentioned below:

     L Fuse-0XEF
     H Fuse-0X99

The GPS receiver modem continu-

ously sends data via USART to IC1 at 9600 baud rate. GPS data is initiated by a '$' sign followed by National Marine Electronics Association (NMEA) output sentences. Details are given in Table I.

The microcontroller continuously captures and stores all bytes for each NMEA output sequence. The total bytes are then partitioned and sampled into a small packet containing information about time, date, longitude, latitude, altitude, speed, etc. These values are regularly updated and displayed on the GLCD.

Construction and testing

An actual-size, single-side PCB for the GPS navigator circuit is shown in Fig. 3 and its component layout in Fig. 4. Assemble the circuit on the provided PCB to minimise assembly errors. Use IC base for microcontroller IC1. You can use a 9V/12V adaptor or any other suitable DC source to power the circuit.

To test the circuit for proper functioning, verify 5V power supply at TP1 with respect to TP0. Reset to the system can be checked at TP2. The data transmitted by the GPS modem can be observed at TP3 using an oscilloscope. ●

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