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Interfacing GPS with LPC2148 ARM

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INTRODUCTION

Global positioning system (GPS) is a space-based satellite navigation system that provides accurate location and time information. The U.S. military developed and implemented this satellite network as military navigation system. At any given time there are at least 24 active satellites orbiting over 12,000 miles above earth. GPS receiver uses a constellation of satellites and ground stations to calculate accurate location wherever it is located. These GPS satellites transmit information signal over radio frequency (1.1 to 1.5 GHz) to the receiver. The data sent down to the earth from each satellite contains time and location information that allows the GPS receiver to accurately calculate its position. After data has been received and position has been calculated, the data is configured according to the standards set-up by NEMA (National Marine Electronics Association) and is serially transmitted.

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

$$Distance = Speed \times Time$$
$$Speed = Speed\ of\ radio\ signal$$
$$Time = T2 - T1$$
$$T1 - Transmit\ time\ of\ signal\ from\ satellite$$
$$T2 - Receive\ time\ of\ signal\ at\ GPS\ Receiver$$

The GPS module continuously transmits serial data in the form of sentences according to NMEA (National Marine Electronics Association) standards. The latitude and longitude values of the location are contained in the GPGGA sentence. Every sentence begins with '$' sign, and ends with a '*' followed by checksum data. The data item in each sentence are seperated by comma. To communicate over UART or USART(Universal Synchronous/Asynchronous Receiver/Transmitter), we just need three basic signals which are, namely, RXD (receive), TXD (transmit), GND (common ground). We need to receive data from the satellite to the LPC2148 Primer Board by using a GPS module through UART0. This data consists of a sequence of NMEA sentences from which GPGGA sentences are identified and processed. The first six bytes of the data received are compared with the pre-stored string and if matched then only data is further accounted for; otherwise the process is repeated again. From the comma delimited GPGGA sentence, latitude and longitude positions are extracted by finding the respective comma positions and extracting the data.

BLOCK DIAGRAM
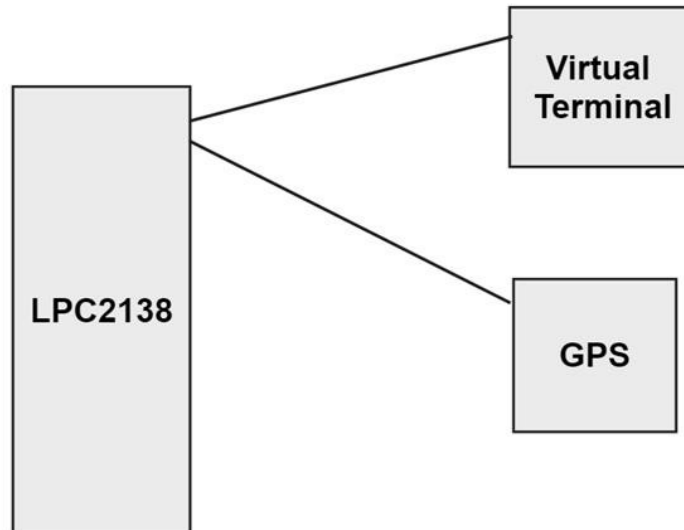
PROTEUS CIRCUIT DIAGRAM
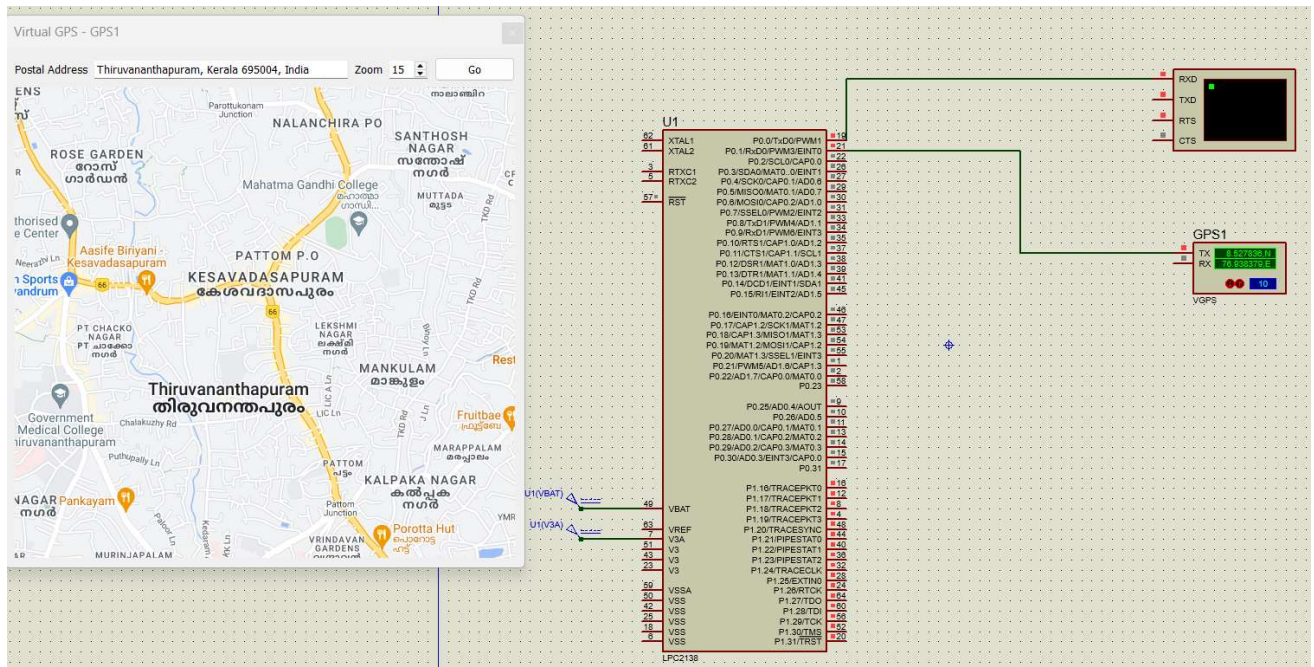
PROGRAM CODE

uart.c

```c
1 #include <LPC214X.h>
2 void UART_init()
3 {
4   PINSEL0 = 0X05; //Enable P0.0 as TXD0 ; P0.1 as RXD0
5   U0LCR = 0X83;
6   U0DLM = 0;
7   U0DLL = 97;
8   U0LCR = 0X03; //Disable DLAB
9
10 }
11
12 unsigned char UART0_GetChar()    //reception
13 {
14   while(!(U0LSR & 0X01));
15   return (U0RBR);
16 }
17 void UART0_PutChar(unsigned char Ch)   //transmission
18 {
19   while(!(U0LSR&0X20));
20   U0THR = Ch;
21 }
22 void UART0_PutS(unsigned char *Ch)    //string message from gps transmitted
23 {
24   while(*Ch)
25   UART0_PutChar(*Ch++);
26 }
```

gps.c

```c
1  #include<lpc214x.h>
2
3  void GPS_string(unsigned char *temp)
4  {
5    unsigned int i = 0;
6    do
7    {
8      temp[i] = UART0_GetChar();
9    }
10   while(temp[i++]!= '*');
11   temp[i]= '\0';
12 }
13
14 void main()
15 {
16   unsigned char ch, temp[100];
17   UART_init();
18
19     while((ch = UART0_GetChar()) == '$');
20     GPS_string(temp);
21     UART0_PutS(temp);
22
23 }
```

RESULT

On successful completion of this project we were able to pin point the GPS location of a place in maps, given its postal address. Given is the accurate location details for the entered postal address 695004.
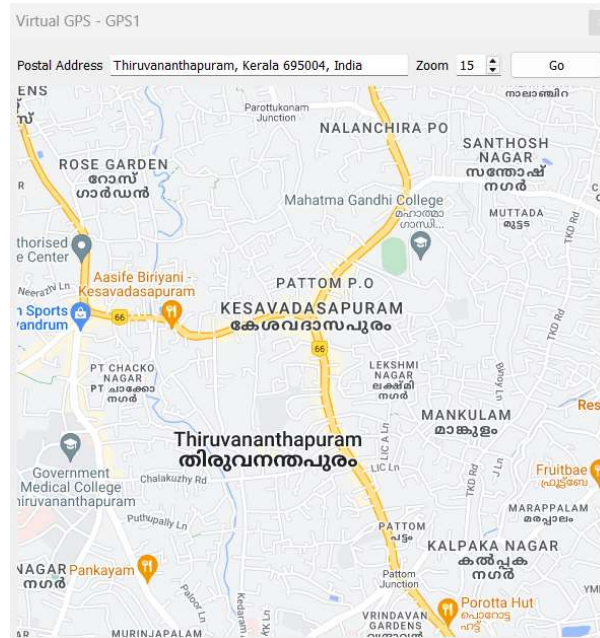
CONCLUSION

GPS module is a serial communication module, hence we have used UART0 for serial communication with LPC microcontroller. GPS systems are extremely versatile and can be found in almost any industry sector. From mining to aviation, agriculture to marine, recreation to defense, there are many applications for GPS technology.

These days, everyone from doctors, scientists, farmers, soldiers, pilots, hikers, delivery drivers, sailors, fishermen, dispatchers, athletes, and people from many other walks of life are using GPS systems in ways that make their work more productive, safer, and easier.

REFERENCES

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