Interfacing GPS Module using LPC2148

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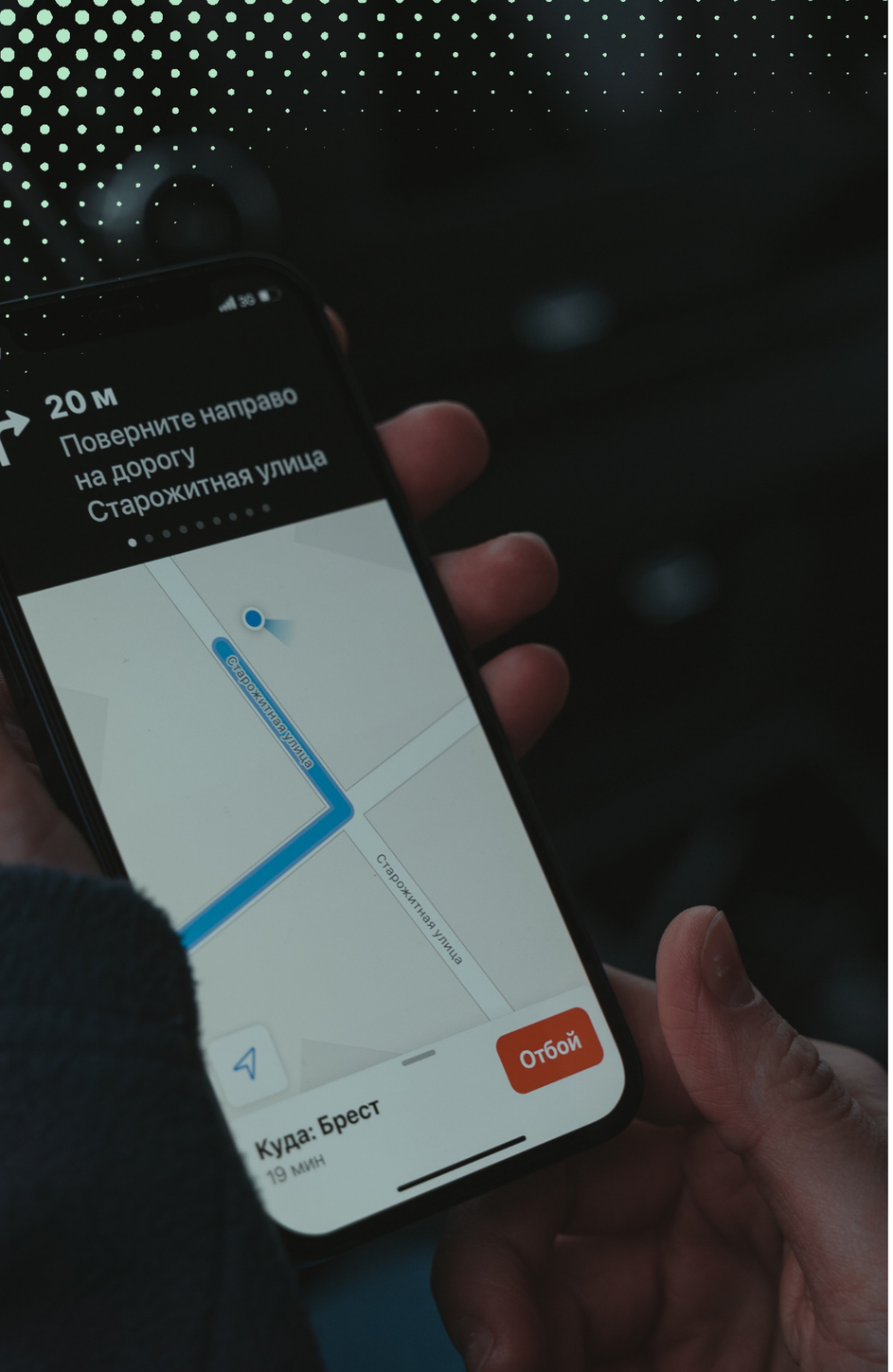
Contents



INTRODUCTION

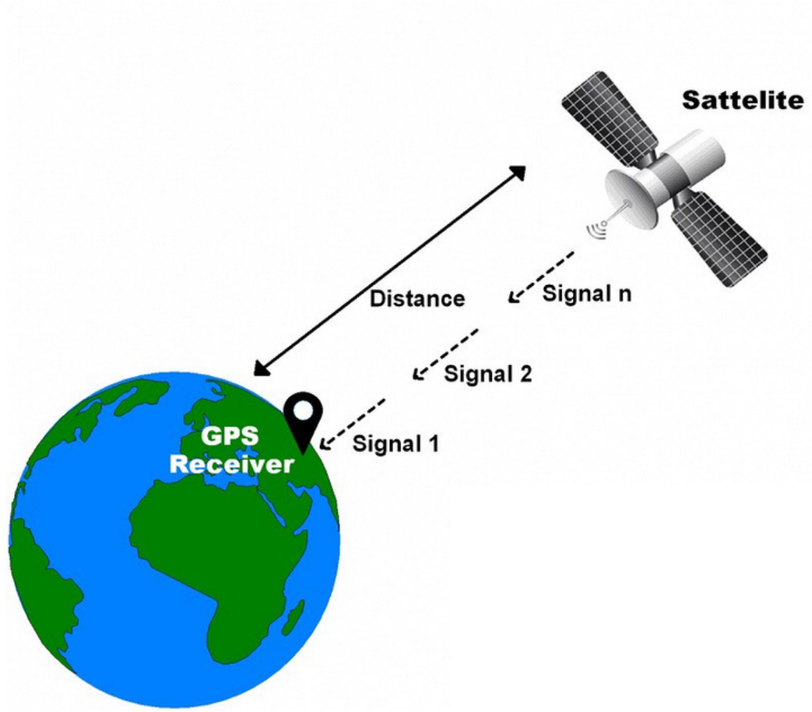
WHAT IS GPS ?

- 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.

HOW DOES A GPS WORK

- 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 x Time
- Speed = Speed of radio signal
- Time = T2 – T1
- T1 – Transmit time of signal from satellite
- T2 – Receive time of signal at GPS Receiver

WORKING

Format of received data stream

```
$GPGGA, 132453.970, 2651.0138, N, 07547.7054, E, 1, 03, 7.1, 42.5, M, 46.9, M, , 0000*45
```

- 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.

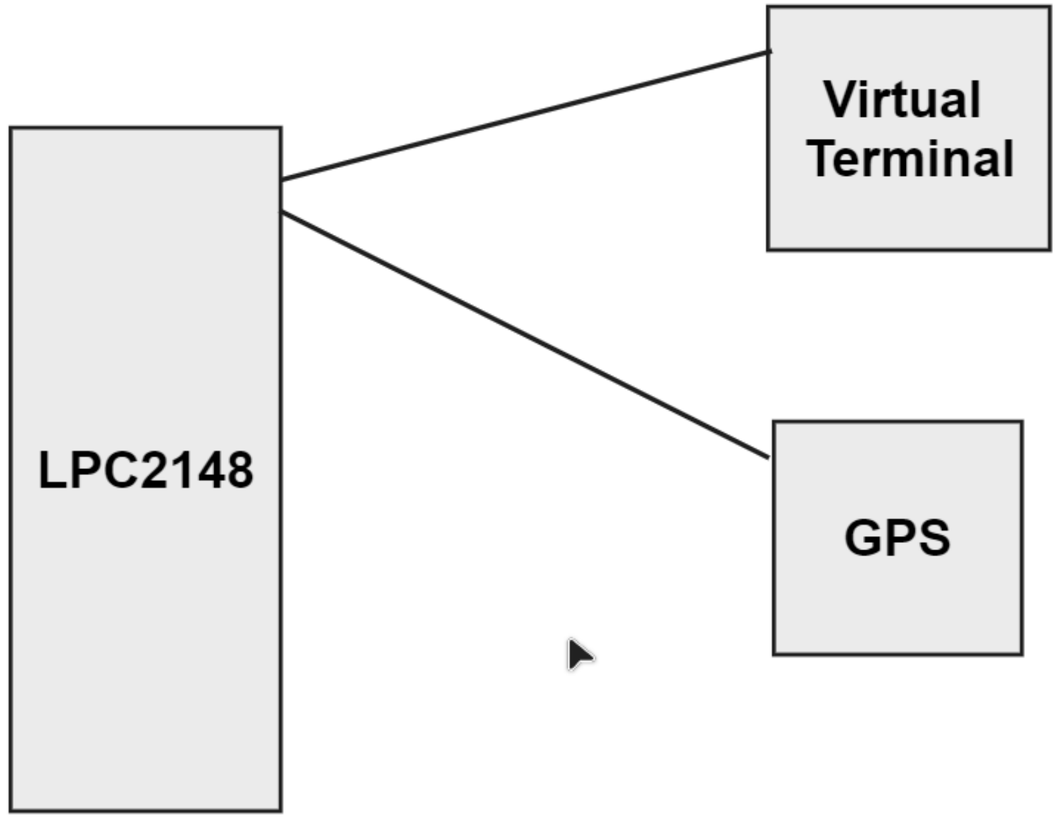
Data	Description
$GPGGA	Global Positioning System Fix data
132453.970	UTC(Coordinated Universal Time) 13hr 24min 53sec
2651.0138 , N	Latitude 26deg , 51.0138’ N
07547.7054, E	Longitude 07deg, 547.7054’ E
1	Fix Quality GPS fix
03	Number of satellites being tracked
7.1	Horizontal dilution of the position
42.5, M	Altitude meters above sea level
46.9, M	Height of geoid (mean sea level)
Empty field	Time in seconds since last DGPS update
Empty field	DGPS station ID number
*45	The checksum data always begins with *

- 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).

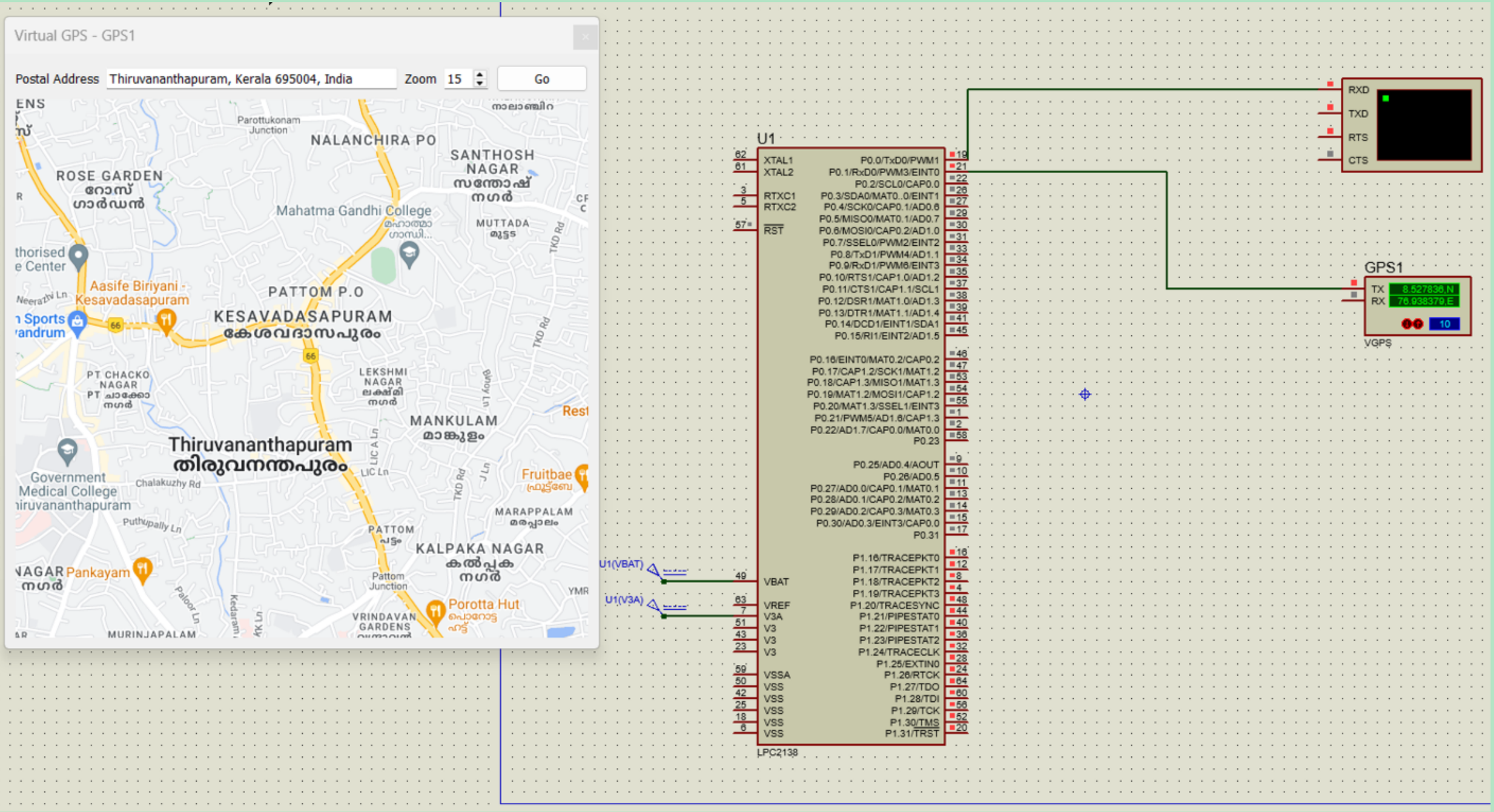
- We need to receive data from the satellite to the LPC2148 Primer Board by using a GPS module through UART0.

- 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 CIRUIT DIAGRAM


Virtual GPS - GPS1
Postal Address
Thiruvananthapuram, Kerala 695004, India
Zoom
15
Go
ROSE GARDEN
റോസ് ഗാർഡൻ
NALANCHIRA PO
SANTHOSH NAGAR
സന്തോഷ് നഗർ
Mahatma Gandhi College
MUTTADA
മുട്ടട
PATTOM P.O
KESAVADASAPURAM
കേശവദാസപുരം
Aasife Biriyani - Kesavadasapuram
PT CHACKO NAGAR
LEKSHMI NAGAR
MANKULAM
മാങ്കുളം
Thiruvananthapuram
തിരുവനന്തപുരം
Government Medical College
Chalakuzhy Rd
Fruitbae
MARAPPALAM
PATTOM
KALPAKA NAGAR
Pankayam
Pattom Junction
Porotta Hut
VRINDAVAN GARDENS
MURINJAPALAM
U1
XTAL1
XTAL2
RTXC1
RTXC2
RST
P0.0/TxD0/PWM1
P0.1/RxD0/PWM3/EINT0
P0.2/SCL0/CAP0.0
P0.3/SDA0/MAT0..0/EINT1
P0.4/SCK0/CAP0.1/AD0.6
P0.5/MISO0/MAT0.1/AD0.7
P0.6/MOSI0/CAP0.2/AD1.0
P0.7/SSEL0/PWM2/EINT2
P0.8/TxD1/PWM4/AD1.1
P0.9/RxD1/PWM6/EINT3
P0.10/RTS1/CAP1.0/AD1.2
P0.11/CTS1/CAP1.1/SCL1
P0.12/DSR1/MAT1.0/AD1.3
P0.13/DTR1/MAT1.1/AD1.4
P0.14/DCD1/EINT1/SDA1
P0.15/RI1/EINT2/AD1.5
P0.16/EINT0/MAT0.2/CAP0.2
P0.17/CAP1.2/SCK1/MAT1.2
P0.18/CAP1.3/MISO1/MAT1.3
P0.19/MAT1.2/MOSI1/CAP1.2
P0.20/MAT1.3/SSEL1/EINT3
P0.21/PWM5/AD1.6/CAP1.3
P0.22/AD1.7/CAP0.0/MAT0.0
P0.23
P0.25/AD0.4/AOUT
P0.26/AD0.5
P0.27/AD0.0/CAP0.1/MAT0.1
P0.28/AD0.1/CAP0.2/MAT0.2
P0.29/AD0.2/CAP0.3/MAT0.3
P0.30/AD0.3/EINT3/CAP0.0
P0.31
P1.16/TRACEPKT0
P1.17/TRACEPKT1
P1.18/TRACEPKT2
P1.19/TRACEPKT3
P1.20/TRACESYNC
P1.21/PIPESTAT0
P1.22/PIPESTAT1
P1.23/PIPESTAT2
P1.24/TRACECLK
P1.25/EXTIN0
P1.26/RTCK
P1.27/TDO
P1.28/TDI
P1.29/TCK
P1.30/TMS
P1.31/TRST
VBAT
VREF
V3A
V3
V3
V3
VSSA
VSS
VSS
VSS
VSS
VSS
U1(VBAT)
U1(V3A)
LPC2138
RXD
TXD
RTS
CTS
GPS1
TX
RX
8.527838,N
76.938379,E
10
VGPS

PROGRAM CODE

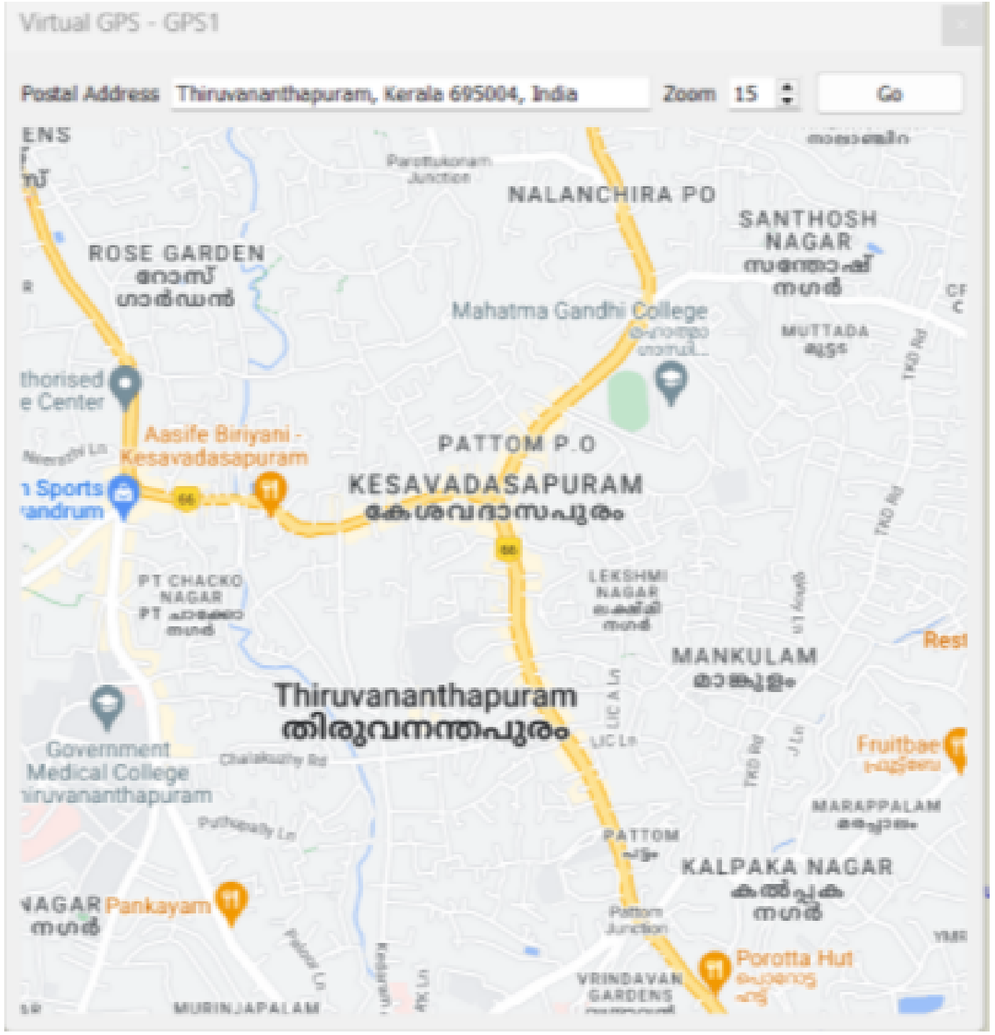
```c
#include <LPC214X.h>
void UART_init()
{
  PINSEL0 = 0X05; //Enable P0.0 as TXD0 ; P0.1 as RXD0
  U0LCR = 0X83;
  U0DLM = 0;
  U0DLL = 97;
  U0LCR = 0X03; //Disable DLAB

}

unsigned char UART0_GetChar()    //reception
{
  while(!(U0LSR & 0X01));
  return (U0RBR);
}
void UART0_PutChar(unsigned char Ch)   //transmission
{
  while(!(U0LSR&0X20));
  U0THR = Ch;
}
void UART0_PutS(unsigned char *Ch)    //string message from gps transmitted
{
  while(*Ch)
  UART0_PutChar(*Ch++);
}
```

uart.c | gps.c

```c
#include<lpc214x.h>

void GPS_string(unsigned char *temp)
{
  unsigned int i = 0;
  do
  {
    temp[i] = UART0_GetChar();
  }
  while(temp[i++]!= '*');
  temp[i]= '\0';
}

void main()
{
  unsigned char ch, temp[100];
  UART_init();

    while((ch = UART0_GetChar()) == '$');
    GPS_string(temp);
    UART0_PutS(temp);

}
```

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 systems are extremely versatile and can be found in almost any industry sector.
- GPS module is a serial communication module, hence we have used UART0 for serial communication with LPC microcontroller.
- 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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THANK YOU