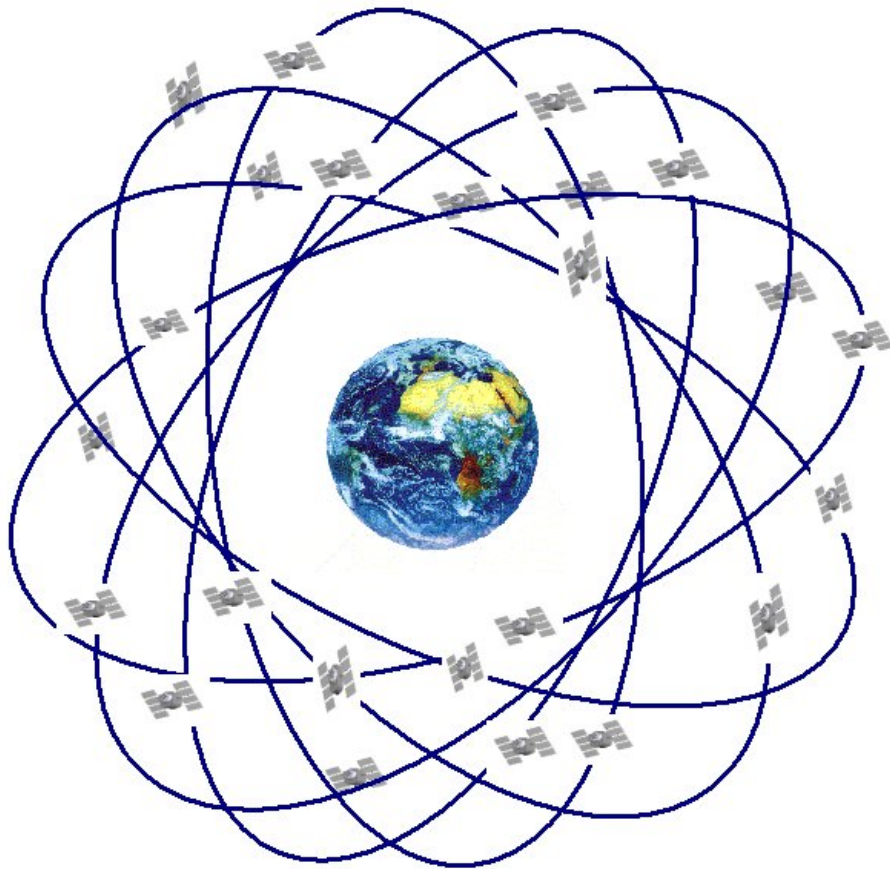


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[A GPS PROGRAM FOR THE RASPBERRY PI]

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Introduction:

The dcgps program is a program that reads and displays GPS information. The program is designed in C and is built primarily to be run on the Raspberry Pi, however, it is portable to any device that is able to compile and run C code while having access to a GPS device.

This document describes the functions, characteristics, capabilities and operation of the dcgps. It is primarily intended to be run on a Raspberry Pi and gather GPS information from the GPS device and display it on a monitor. It is structured and designed however to be portable across other civilized and uncivilized systems. The GPS device used is the ND100S USB GPS dongle.

Functional Description:

The dcgps is designed to gather and display information from a GPS device. The program is meant primarily to be run on a linux system, primarily the Raspberry Pi, however, because the program has been written in C, the program is flexible and can be quickly adapted to run on other systems. The dcgps will include the following information:

- Total satellites visible
- The type of fix (2D, 3D or No Fix)
- PRN: The ID of the satellite
- SNR : The signal to noise ratio of the connection between the device and the satellite
- Elev: The elevation of the Satellites.
- Azimuth: The angle at which the satellite is to the device
- Whether the satellite that is visible is being used or not
- Latitude: The degree and whether it is North or South
- Longitude: The degree and whether it is West or East
- Altitude: Displayed in meters
- Speed: Displayed in kilometers per hour
- Timestamp: Includes current time and date

Upon the user wishing to exit the program, dcgps will close the GPS stream and free all resources.

Devices:

The dcgps program is dependent on the following devices:

- Raspberry Pi: a single board computer running a Linux operating system. A 512 MB Model 2 Raspberry Pi board was used in development.
- USB GPS Device: a USB GPS device that is capable of plugging into a USB port on the pi. The ND-100D GPS Dongle was used in development.

Operating System:

The operating system installed on the Raspberry pi is Raspbian and is loaded to the Raspberry Pi by SD card.

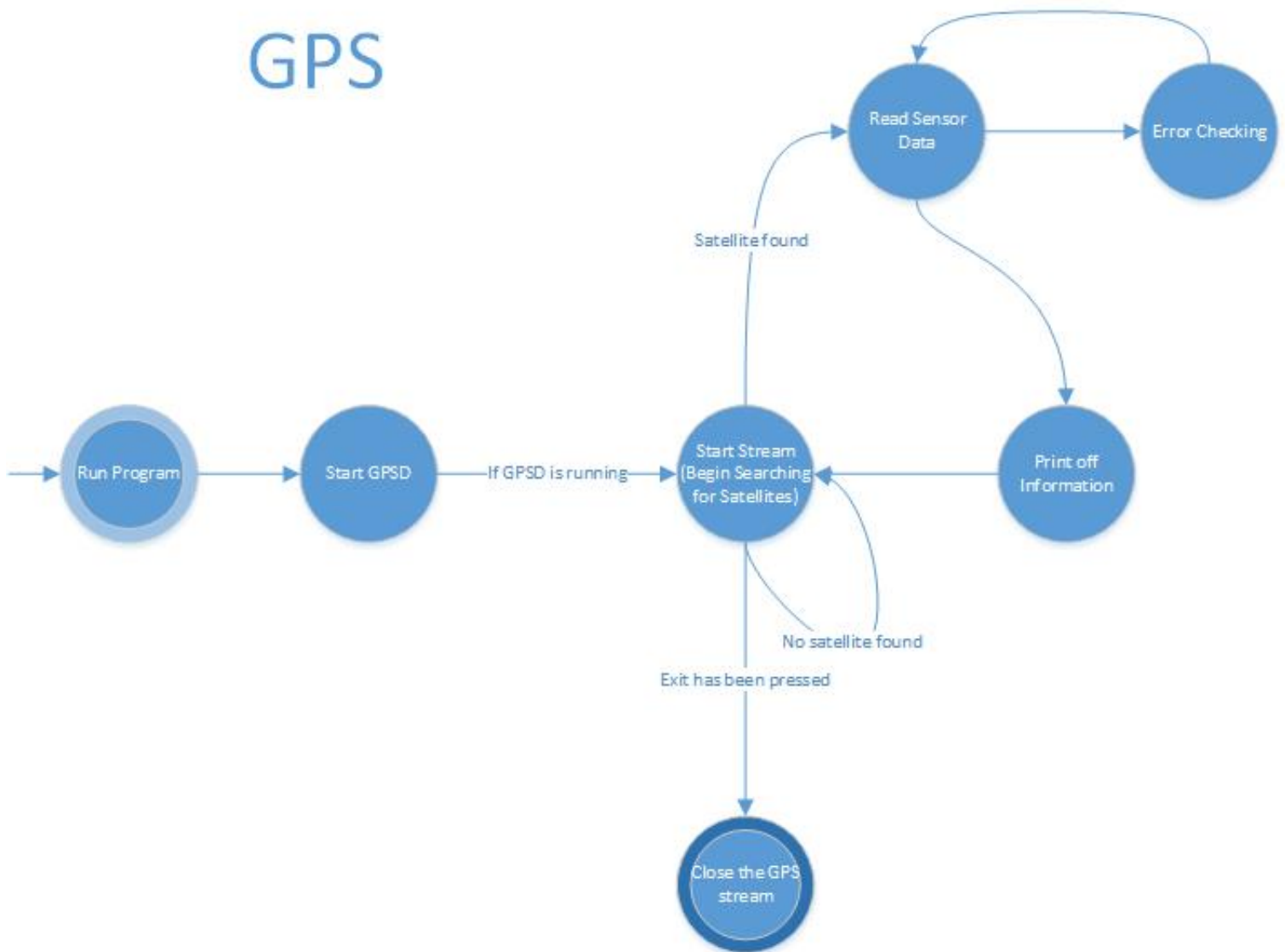
Operating Instructions:

To operate the program, dcgps must be run from terminal. Simply go to the folder where the program has been installed, and type:

- `killall gpsd`
- `gpsd /dev/ttyUSB0 -F /var/run/gpsd.sock`
- `run ./dcgps` to begin the program.

State Diagram:

GPS



Pseudocode:

```
main function{
    initialize all variables for GPS data
    malloc gps_data_ptr

    open GPS stream (make sure gpsd is running properly)
        if the GPS cannot find device, print error that the device is error
    read()
}

read function{
    wait for GPS to be connect
    if reading the GPS gives error,
        print error message

    errorCheck()
    if errorCheck()
        print error message
        returns -1 (failure),

    Read Satellite data
        If ErrorChecking() returns good
    PrintData()
}

errorCheck function{
    Check for error from data coming in from stream
}

PrintData{
    //PRINT SATELLITE INFORMATION
    Print PRN, SNR, Elevation, Azi, Used
    //PRINT GPS INFORMATION
    Print Latitude, Longitude, Altitude, Speed, Timestamp
    Print N/A if all data is not available
}

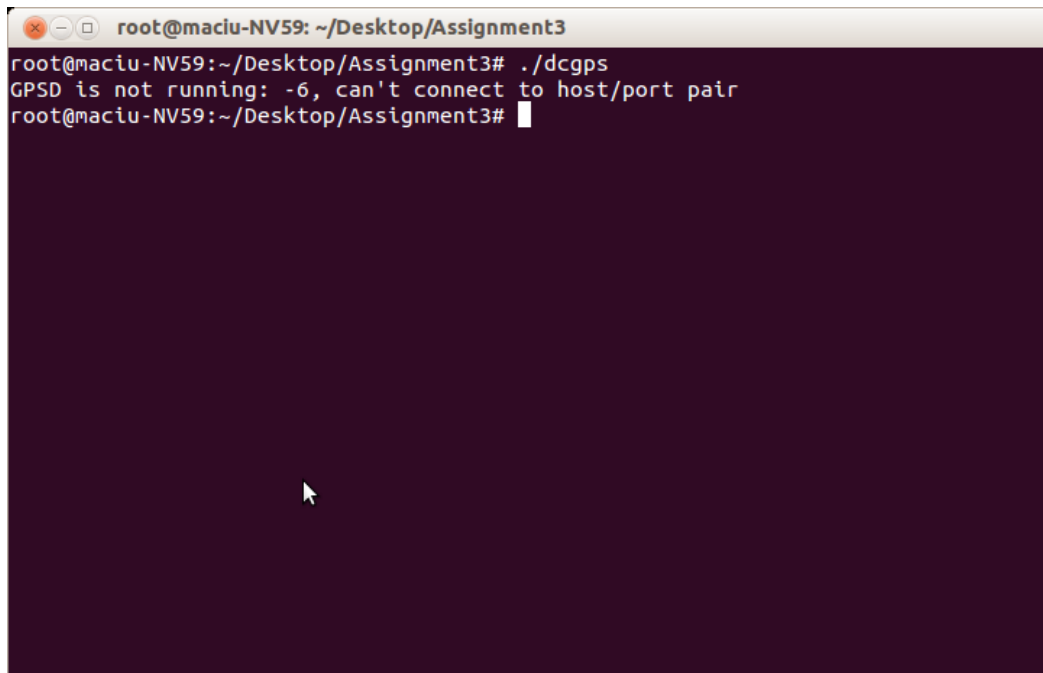
closeGPS{
    close GPS
    clean up all GPS variables
}
```

Test Cases:

Test	Tests Description	Tools Used	Expected Result	Pass/Fail	Notes
1	Read the GPS device (GPS_OPEN)	dcgps	The device should be read & GPSD should be running	Fail	See Figure 1
2	Read the GPS device(GPS_OPEN)	dcgps	The device should be read & GPSD should be running	Pass	See Figure 2
3	Open GPS Stream	dcgps	Device should be reading and there should be no GPS_TIMEOUT	Fail	See Figure 3
4	Open GPS Stream	dcgps	Device should be reading and there should be no GPS_TIMEOUT	Pass	See Figure 4
5	Read information From Satellite	dcgps	Information from the satellite should be displayed	Fail	See Figure 5
6	Read information From Satellite	dcgps	Information from the satellite should be displayed	Pass	See Figure 6
7	Run the application on the Raspberry PI	Raspberry Pi/dcgps	The program should run on the Raspberry Pi	Pass	See Figure 7

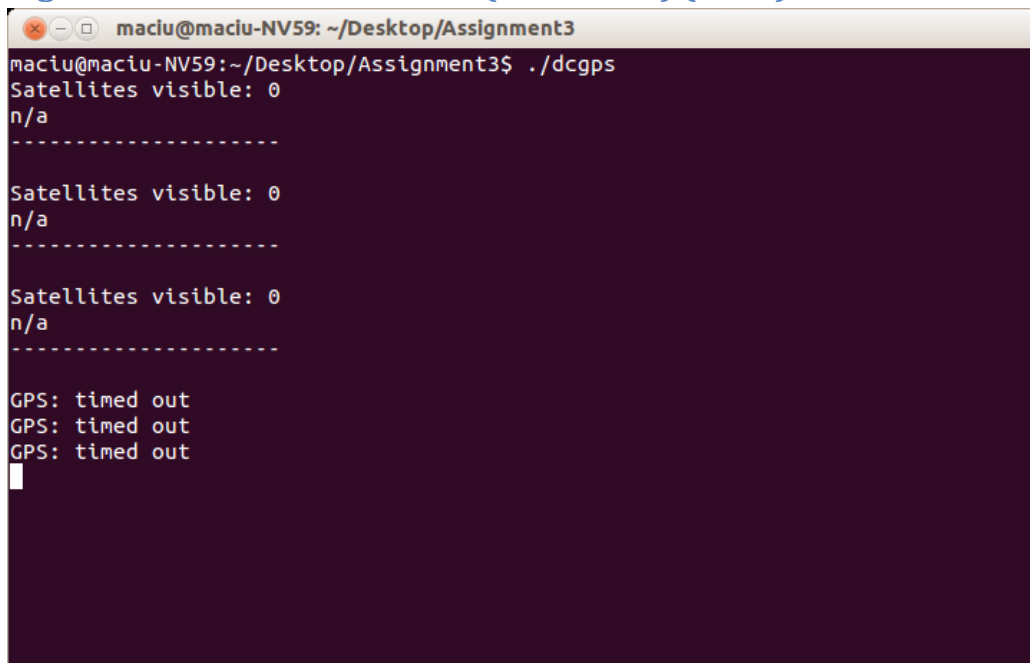
Figures:

Figure 1: Read the GPS device (GPS_OPEN) (FAIL)



```
root@maciu-NV59: ~/Desktop/Assignment3
root@maciu-NV59:~/Desktop/Assignment3# ./dcgps
GPSD is not running: -6, can't connect to host/port pair
root@maciu-NV59:~/Desktop/Assignment3#
```

Figure 2: Read the GPS device (GPS_OPEN) (PASS)



```
maciu@maciu-NV59: ~/Desktop/Assignment3$ ./dcgps
Satellites visible: 0
n/a
-----

Satellites visible: 0
n/a
-----

Satellites visible: 0
n/a
-----

GPS: timed out
GPS: timed out
GPS: timed out
```

Figure 3: Open GPS Stream (FAIL)

```
maciu@maciu-NV59: ~/Desktop/Assignment3
maciu@maciu-NV59:~/Desktop/Assignment3$ ./dcgps
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
n/a
-----
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
n/a
-----
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
n/a
-----
GPS: timed out
█
```

Figure 4: Open GPS Stream (PASS)

```
root@maciu-NV59: ~/Desktop/Assignment3
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:31.370Z
-----
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:31.370Z
-----
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:32.360Z
-----
Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:33.360Z
-----
█
```

Figure 5: Read information From Satellite (FAIL)

```
root@maciu-NV59: ~/Desktop/Assignment3
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:31.370Z
-----

Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:31.370Z
-----

Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:32.360Z
-----

Mateusz Siwoski A00758640      Robin Hsieh A00
Satellites visible: 0
NO FIX
Timestamp: 2013-11-09T21:37:33.360Z
-----
```

Figure 6: Read information From Satellite (PASS)

```
maciu@maciu-NV59: ~/Desktop/Assignment3
PRN:25 SNR:17.000000.0 Azi:67 Used:Y
PRN:12 SNR:19.000000.0 Azi:30 Used:Y
PRN:1 SNR:36.000000.0 Azi:259 Used:Y
LAT:49.148908 LON:-122.798870
ALT:22.821000
Timestamp: 2013-11-09T03:16:35.000Z
-----

Satellites visible: 9
PRN:32 SNR:36.000000.0 Azi:298 Used:Y
PRN:20 SNR:21.000000.0 Azi:295 Used:Y
PRN:14 SNR:17.000000.0 Azi:61 Used:Y
PRN:11 SNR:26.000000.0 Azi:226 Used:Y
PRN:31 SNR:27.000000.0 Azi:127 Used:Y
PRN:17 SNR:14.000000.0 Azi:318 Used:Y
PRN:25 SNR:17.000000.0 Azi:67 Used:Y
PRN:12 SNR:19.000000.0 Azi:30 Used:Y
PRN:1 SNR:36.000000.0 Azi:259 Used:Y
LAT:49.148908 LON:-122.798870
ALT:22.821000
Timestamp: 2013-11-09T03:16:36.000Z
-----
```

Figure 7: Program executed on Raspberry Pi (PASS)

