# PPG Signal Processing with Database Interface

Photoplethysmogram (PPG) signals are collected using sensors for ECG, SpO2, and a accelerometer and stored in the database ppg_base.db. There are three different measurements, one for the volunteer person standing, one for the running person, and one for the walking person, all these measurements are stored in the database. There are five tables, one for each signal type in the database. In this example, we illustrate how signals can be fetched from the database, and further plotted and/or processed.

First, we show SpO2 together with the accelerometer data for a single measurement, in the case of running which is under ID 2 in the database tables.

```
1  dbn := user dir() + "/Flexitek/" + "ppg_base.db"
2  file copy("ppg_base.db", user dir() + "/Flexitek")
3  SpO2 := database read(dbn,"wrist")
4  qu1 := "SELECT column0 FROM wrist WHERE column1=2"
5  M1 :=  database query(dbn, qu1)
```

Next, we need the time variable in order to make time domain plots. The time vector is also in the database.

```
6  qut := "SELECT column2 FROM wrist WHERE column1=2"
7  time := database query(dbn, qut)
8  M1_graph := join mat cols(time, M1)
```



We need to compare the above signal with the movement data which is also in the database in the form of accelerometer data for all three axis. We make the appropriate queries to extract the data.
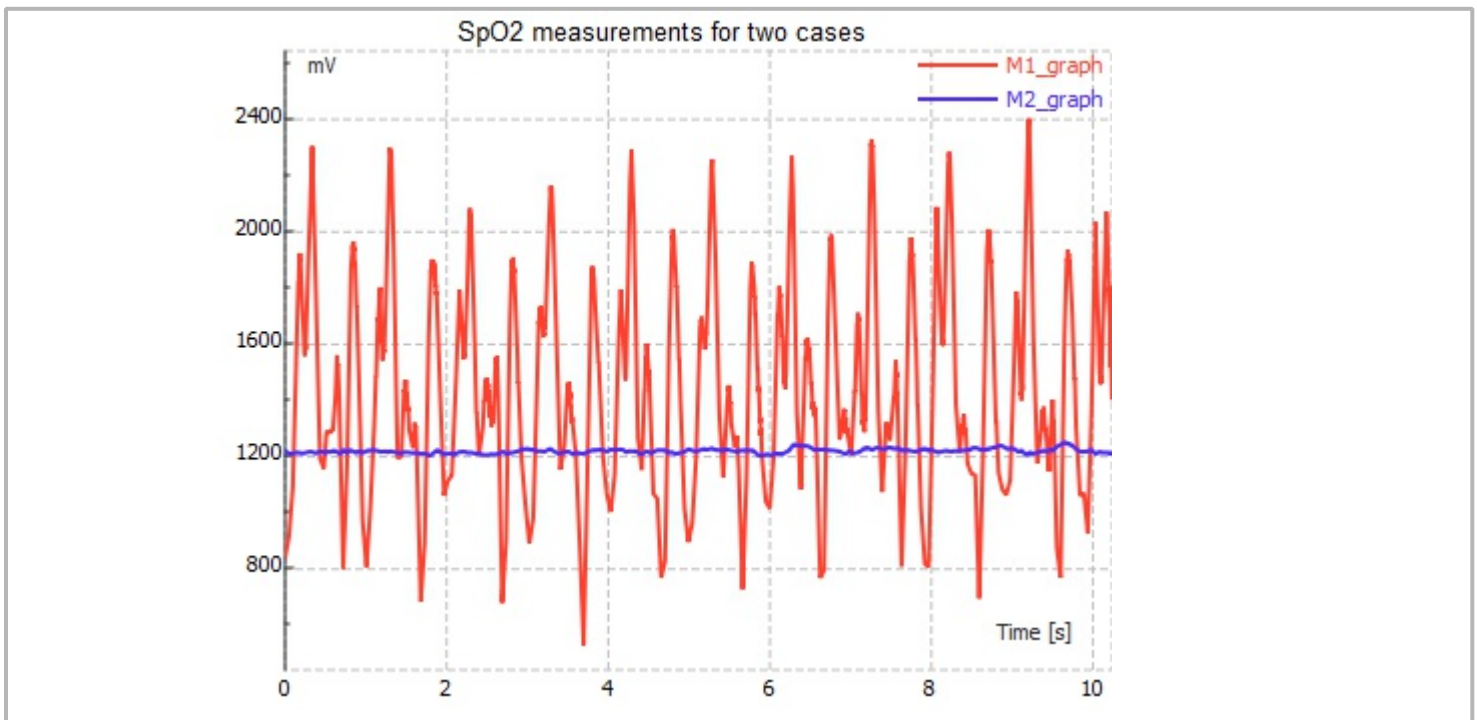
```
9   Xa := database read(dbn,"accelometer_x")
10  qux := "SELECT column0 FROM accelometer_x WHERE column1=2"
11  Xad :=  database query(dbn, qux)
12  X_g := join mat cols(time, Xad)
13  Ya := database read(dbn,"accelometer_y")
14  quy := "SELECT column0 FROM accelometer_y WHERE column1=2"
15  Yad :=  database query(dbn, quy)
16  Y_g := join mat cols(time, Yad)
17  Za := database read(dbn,"accelometer_z")
18  quz := "SELECT column0 FROM accelometer_z WHERE column1=2"
19  Zad :=  database query(dbn, quz)
20  Z_g := join mat cols(time, Zad)
```

All three signals corresponding to the three axis are shown in a single graph. From the figure, it is evident that the person is moving, as all three signals show significant acceleration.



Accelometer data - running
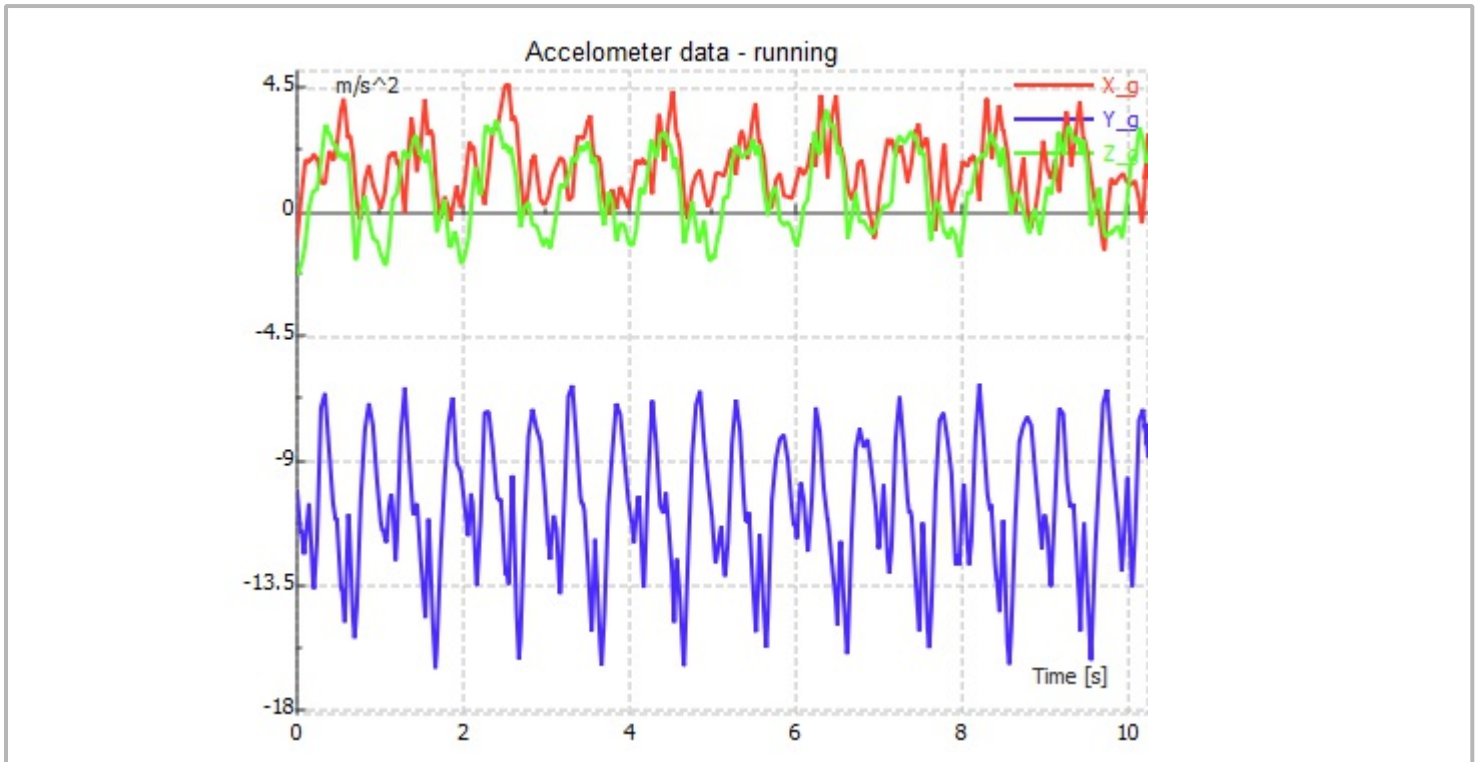
We compare SpO2 data for both the standing and running case , and we give the accelerometer data regarding the standing case

```
21  qu2 := "SELECT column0 FROM wrist WHERE column1=1"
22  M2 :=  database query(dbn, qu2)
23  M2_graph := join mat cols(time, M2)
```



SpO2 measurements for two cases

```
24  qux1 := "SELECT column0 FROM accelometer_x WHERE column1=1"
25  Xad1 :=  database query(dbn, qux1)
26  X_g1 := join mat cols(time, Xad1)
27  quy2 := "SELECT column0 FROM accelometer_y WHERE column1=1"
28  Yad2 :=  database query(dbn, quy2)
```

```
29
30  Y_g2 := join mat cols(time, Yad2)
31  quz2 := "SELECT column0 FROM accelometer_z WHERE column1=1"
32  Zad2 :=  database query(dbn, quz2)
33  Z_g2 := join mat cols(time, Zad2)
```



Accelometer data - standing