



# Royal Dutch Visio

## Case Study



*Investing in the future by working together for a sustainable and competitive region*



# 1 Executive summary

Royal Dutch Visio is an institute that supports the blind and visually impaired by answering their questions about life, learning, living and working with a visual impairment. One of the activities of Visio is assisting the blind and visually impaired with training sessions to improve their condition and stamina. The blind and visually impaired they assist often suffer from intellectual disabilities to some degree.

During these training sessions the agogues assist one client each. It would be an improvement if these agogues could assist multiple clients simultaneously. To accomplish this the Royal Dutch Visio asked the Hanze University of Applied Sciences to come up with a solution. Four students of the School of Computer Science accepted the challenge to develop an application that will allow the agogues to enhance their training sessions by means of new ICT and mobile technologies, resulting in a higher capability; the agogues can train multiple clients at once now.

The main goal of this project is to improve the overall condition and stamina of the clients of Royal Dutch Visio. The application needs to be very user-friendly for its users and keep track of the heart rates of the clients during training sessions.

The application these four students developed motivates clients to exercise on their own by playing their favourite music when the clients have an elevated heart rate. The heart rate is used as a measure for effort. The application records the heart rates of the clients during the training sessions. With this data employees of Visio can track the progress of the clients and set up personalised training programmes for the clients. Physiotherapy students can use it for their studies.

In the current stage of development it is not yet possible to use this application to help stimulate clients during their training sessions. It is not yet possible to pair a heart rate monitor with the application. The required protocol to read data from the heart rate monitor has not yet become available; it still needs to be obtained from the manufacturer of the heart rate monitors.

To overcome this obstacle for the time being a heart rate simulator was used to develop the application. This simulator simulates the heart rate of a client. Once the protocol is known the application will be modified accordingly.

## 2 Problem statement

In the current situation the agogues can only support a single client at a time. The agogues spend their time motivating the clients to exercise, to improve their condition and stamina.

The agogues can encourage the clients during these one on one sessions, but their time is limited. It is not possible for the agogues to support multiple clients simultaneously since every client needs to be motivated to move and train. Royal Dutch Visio expressed a need for a technical solution to this problem.

Using technical and auditory tools the agogues could assist multiple clients at once, greatly increasing the time clients get for training sessions. The following technical tools will be used:

- Smartphone with android operating system
- Bluetooth™ heart rate monitor
- Laptop / Server running the MySQL Database.

The heart rate of the clients need to be recorded during the training sessions; this data can be used later to analyze the condition of the client(s), and to see whether the condition is improving.

### 3 Alternatives

An obvious alternative to this technical solution is simply to employ moreagogues to assist the clients. With moreagogues it is possible to provide the clients with more hours of training sessions. However, this is very costly and the demographic development leads to a lesser availability ofagogues, and therefore not a viable solution.

Another technical solution would be to use something other than a client's heart rate as a means of measure. When the client is exercising on a slightly modified home trainer it may be possible to measure the virtual distance the client has travelled. However, It is costly to modify all exercise devices. Even when all devices are modified, it would still be impossible to compare the results of different measurements taken on different devices. The heart rate of a client is an equal means of measurement, no matter which device they are exercising on.

Modifying exercise devices to measure distance or something similar would make a nice addition to the current technical solution. Not all exercise devices would need to be modified. With both a heart rate and a distance of a measurement it would be possible to give a better picture of the (overall) condition of a client, compared to having only a heart rate.

## 4 Conclusion

At the time of writing this article the product cannot yet be deployed within Royal Dutch Visio due to the lack of documentation for the Bluetooth™ protocol of the heart rate measurement devices.. Not much can be said yet about any improvement in the condition and stamina of clients of Royal Dutch Visio, tests in practice will have to prove the effectiveness of the solution that was developed.

The application that has been developed is very user-friendly. Technical skills are not required to operate either the smartphone or web application. It is possible to monitor several clients simultaneously.

The smartphone application will show the current heart rate of a client and stimulate the client to exercise by playing their favourite music through the smartphone.

The web application will show the current heart rates of all connected clients. The heart rates of all clients will be recorded in a database for later use. It is possible to show these heart rates as individual graphs or combined into a bar graph. The data can also be exported to an excel file.

To simulate a heart rate, a simulator has been developed. The application has been tested thoroughly using this simulator. Unfortunately it has not been possible yet to test this application using actual heart rate monitors as said before.

## 5 Implementation

The smartphone application has been developed for smartphones running the android operating system, version 1.7 or higher. When the smartphone application is started the agogue can start a measurement with one additional (and quite literal) “touch” of a button.

The application plays music when the heart rate of the client is elevated. Music is used as a motivator to get the clients to exercise. During a measurement it is possible to alter variables such as the bottom and ceiling heart rate of the client. The heart rate of the client should remain between the bottom and the ceiling heart rate during a training exercise. The agogue can also change the playlist of the client and even set up the application for another client.

The heart rate of the client is recorded and sent to a MySQL database on a local server through WiFi. The web application uses this data in various ways. While one or several android applications are running, it is possible to get an overview of all running measurements by means of a “Live Monitor”. With this, an agogue can observe a large group of clients simultaneously and intervene when needed. The individual heart rate of clients is also shown on the display of the smartphones themselves.

New clients are added to the system through the web application and existing clients can be adjusted using the web application. The bottom and ceiling heart rate of a client can be altered, as well as their music playlist. New music can be added to the system and existing music can be deleted from the system.

One great feature of the web application is the rendering of the heart rate data of clients into charts. Individual measurements can be shown in a chart, but they can also be combined into a chart spanning multiple sessions. These charts can be exported and printed in the web application and the data itself can be exported as an excel file as well.

The web application is running on a local server in a closed network. The web application can therefore only be accessed from within this network, however if the server is configured for use on the whole network (or even the internet), it will be accessible from everywhere.

At the time of writing the android application cannot yet read the data from a heart monitor. Instead a heart rate simulator is used. This simulator sends its data over Bluetooth to the android application. The simulated heart rate is a perfect sine. This simulated heart rate is realistic, yet very predictable. This sine can also be reconstructed from the recorded heart rate of the simulator. Bluetooth was chosen for the simulator as well, so that when the protocol becomes available, it will only take a few hours to set the system up for a “production environment”.

## 6 Participants

There are several parties involved in the development of this application.

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