



mHealth PC Application

User's Guide

Mladen Milošević

Wil Gilmore

Contents

1	Introduction.....	2
2	Application Overview	3
2.1	Config	3
2.1.1	Zephyr Settings	3
2.1.2	Database Connection Settings.....	4
2.1.3	Session Options	4
2.1.4	Debug Data	4
2.2	Display Live Data	5
2.2.1	Display Signals	6
2.2.2	Axis Settings.....	6
2.2.3	Battery Status Indicator.....	7
2.2.4	Video Feed	7
2.3	Activity Viewer	7
2.4	Define Protocol	8
2.5	View Old Sessions	9
3	A Sample Walkthrough.....	9
4	Troubleshooting	17

1 Introduction

The purpose of this document is to provide an overview of the UAH mHealth PC Application used for collecting and analyzing data from a Zephyr™ Bioharness™ BT sensor. This document will overview all major features of the application, followed by an example walkthrough to demonstrate how the application may be used. In addition, a troubleshooting section is included to identify and resolve common issues that may arise when using the application. .

This document assumes that user already has basic knowledge of the Zephyr™ Bioharness™ BT, including its operation and sensor capabilities. In addition, this document and the associated application is intended for users associated with UAHuntsville's mHealth research and are not intended for users outside of its target audience.

2 Application Overview

The main window of the application, as shown below in Figure 1, consists of five tabs. The *Config* tab, displayed in Figure 1, is first displayed when the application is started. A detailed explanation of each tab is provided in the following subsections.

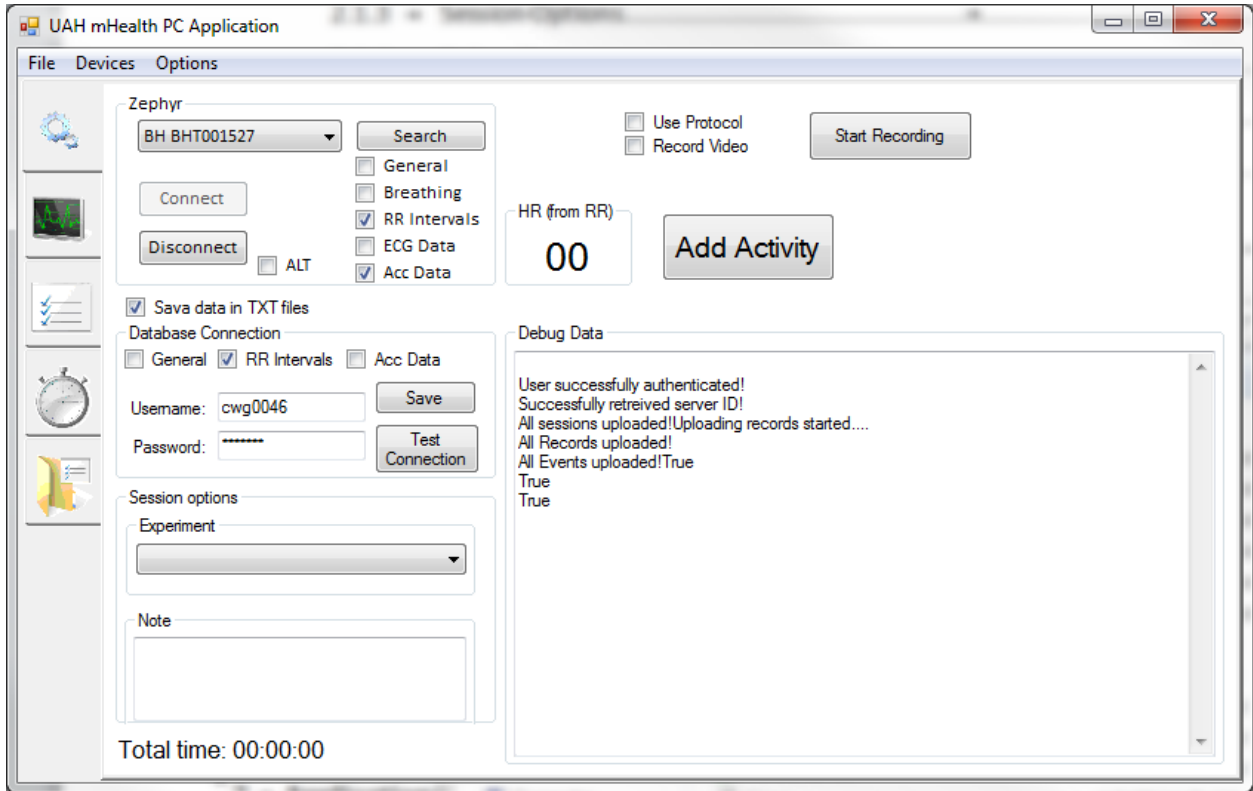


Figure 1 mHealth PC Application Configuration Tab

2.1 Config

From this tab, the user is able to configure the application for use, including Zephyr sensor settings, database connection settings and session options. Additionally, the user is able to start recording data from the sensor by pressing the *Start Recording* button, as well as enable or disable the use of protocols and video by checking or unchecking the *Use Protocol* and *Record Video* checkboxes respectively. Lastly, the user may change whether or not received sensor data is saved locally as text files by checking the *Save data in TXT files* checkbox. The *Heart Rate (from RR)* only displays a value during a recording session.

2.1.1 Zephyr Settings

These settings are shown below in Figure 2 Zephyr Settings. From here, the user selects what data sensor data to monitor, as well as connect to the sensor. The user may select to record *General Data*, *Breathing*, *RR Intervals*, *ECG Data* or *Accelerometer Data*. The user may either search for the device by pressing the *Search* button or by first selecting the *ALT*

checkbox, then pressing the *Search* button. The former lists all nearby bluetooth devices in the dropdown menu, while the latter lists all available COM ports on the machine. To connect, the user selects the correct device or COM port from the dropdown menu, and then presses *Connect*. To disconnect, simply press the *Disconnect* button. Please see the *troubleshooting* section if issues arise when connecting to the sensor.

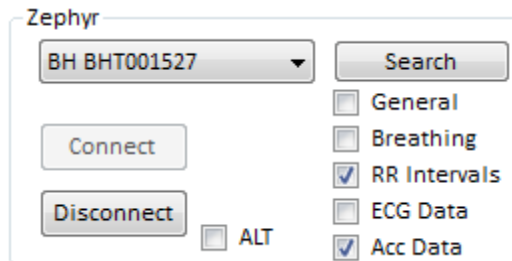


Figure 2 Zephyr Settings

2.1.2 Database Connection Settings

Shown in Figure 3, these settings control the connection to the mHealth file server, including what data to upload to the server. In order to upload data to the server, a valid username and password must be entered in. The user can test the validity of the entered username and password by pressing the *Test Connection* button. The user can also save the password information for future use by pressing the *Save* button. Note that only general data, RR Intervals and Accelerometer data may be uploaded to the mHealth server.

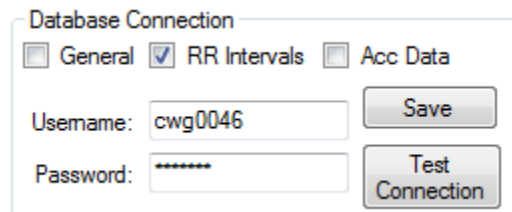


Figure 3 Database Connection Settings

2.1.3 Session Options

Reserved

2.1.4 Debug Data

The *Debug Data* window, shown in Figure 4, displays application messages and is intended for troubleshooting problems with the application.

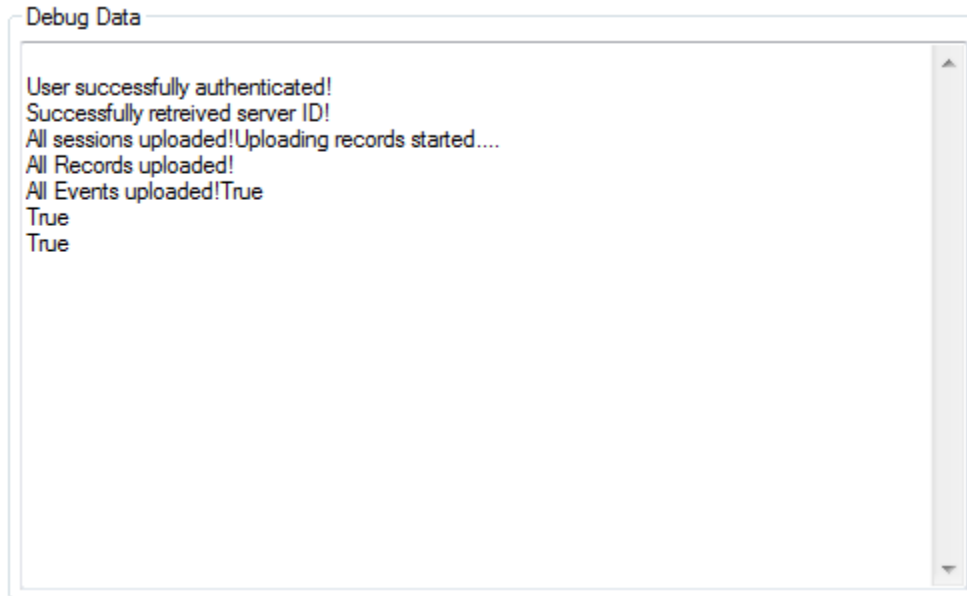


Figure 4 Debug Data Window

2.2 Display Live Data

From this tab, sensor data can be graphically viewed as it is received by the application. The user may toggle which data is currently displayed on the graph and to which Y-axis the data is mapped. The user can also change axis settings, zoom in/out, view the battery life of the device and view the video feed. The layout of this tab is below in Figure 5.

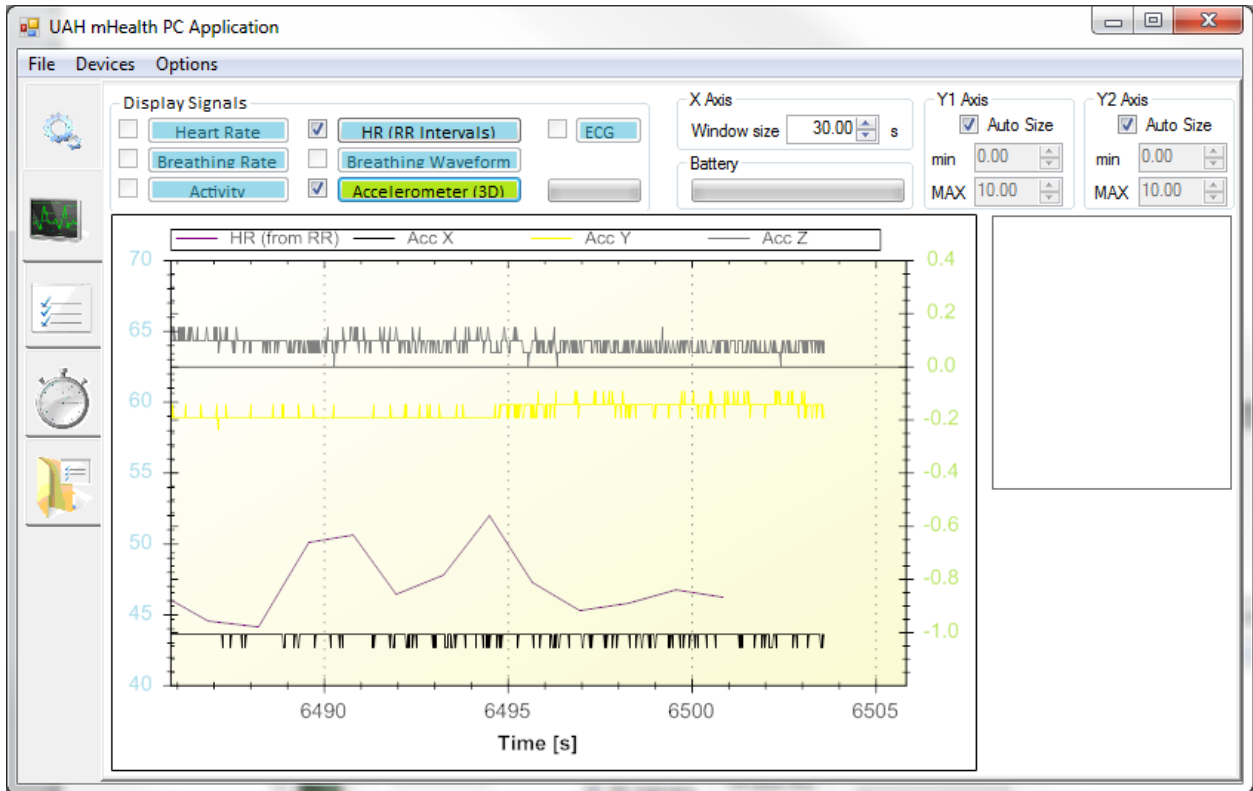


Figure 5 Display Live Data

2.2.1 Display Signals

The user may select which sensor data to display by checking/unchecking the checkbox next to the type of sensor data. Only the selected data types from the Zephyr settings on the *config* tab may be displayed on the graph. Unselected data types will be greyed out and cannot be displayed on the graph. Additionally, the Y-axis the data is mapped to can be changed by clicking on the name itself, changing the displayed color. If the background is blue, the data is mapped to the left Y-axis. If green, it is mapped to the right Y-axis. For example, in Figure 5 above, the *HR (RR Intervals)* displays blue, meaning that its data is mapped to the left Y-axis, while the *Accelerometer (3D)* data displays green, meaning that it is mapped to the right Y-axis.

2.2.2 Axis Settings

From the axis settings, shown in Figure 6, the user can adjust the X and Y-axis properties. For the X-axis, the *Window size*, the length of the X-axis in seconds, can be adjusted. For the Y-axes, auto-scaling can be turned on or off. When auto-scaling is turned off, the user can manually set the minimum and maximum values for each Y-axis by setting the *min* and *MAX* values respectively.

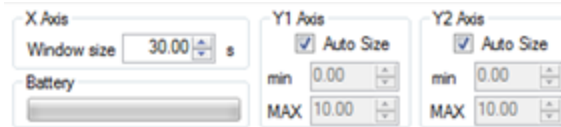


Figure 6 Axis Settings and Battery Status Indicator

2.2.3 Battery Status Indicator

The battery status indicator, shown above in Figure 6, displays the battery life of the Zephyr sensor. It is currently unimplemented.

2.2.4 Video Feed

The live video feed from the camera can be viewed in the viewing area located to the right of the graph.

2.3 Activity Viewer

The *Activity Viewer* tab, shown below in Figure 7, displays all activities performed during recording sessions, acting as a history of activities performed, along with the duration of the activity and the date and time the activity was performed.

Activity	Time	Duration
Sit	2012-10-18 11:27:14	29
Stand	2012-10-18 11:27:45	30
Sit	2012-10-18 11:28:15	60
Stand	2012-10-18 11:29:16	30
Sit	2012-10-18 11:29:47	30
Sit	2012-10-18 12:09:03	27
Sit	2012-10-18 12:10:20	4
Sit	2012-10-18 12:21:19	2
Sit	2012-10-18 12:25:37	6
Sit	2012-10-18 12:26:49	29
Stand	2012-10-18 12:27:19	30
Sit	2012-10-18 12:27:50	60
Stand	2012-10-18 12:28:50	30
Sit	2012-10-18 12:29:21	30

Figure 7 Activity Editor

2.4 Define Protocol

From the *Define Protocol* tab, shown in Figure 8, a protocol can be created, saved, modified and loaded into the application. A protocol defines a set of activities to be performed during a recording session. While recording, the protocol will direct subjects being monitored to perform certain actions, such as sitting, standing, etc. For an example of this, please refer to the sample walkthrough in section 3.

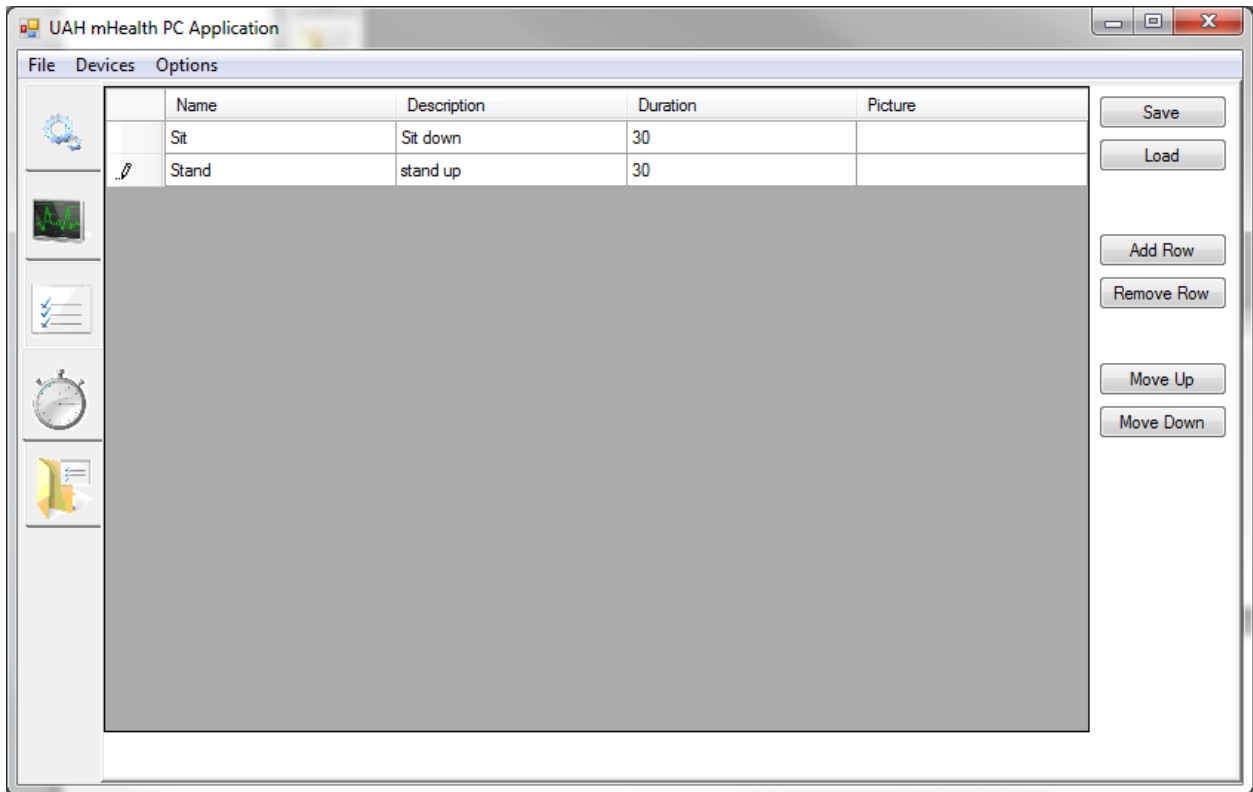


Figure 8 Define Protocol

To add an activity to the protocol, click the *Add Row* button. The *Name*, *Description* and *Duration* fields may then be modified by clicking the individual cells and then typing. The *Duration* field is the duration of the activity and is input in seconds. The fields may be modified at any time. In addition, the order of the activities in the protocol can be modified by selecting a row and clicking the *Move Up* or *Move Down* buttons. To remove an activity from the protocol, select the activity, and then click *Remove Row*. The *picture* field associates a picture with the activity. Type in the filename of a picture to associate that picture with the activity. Only pictures can be used that are located within the *images* folder in the location of the executable.

Once modification is complete, the protocol can be saved by clicking the *Save* button. The protocol can then be loaded into the application by clicking the *Load* button. If a recording

session is to use a protocol, the protocol as it is currently displayed in this tab will be the protocol used.

2.5 View Old Sessions

Previously recorded data can be loaded from the *View Old Sessions* tab, shown in Figure 9.

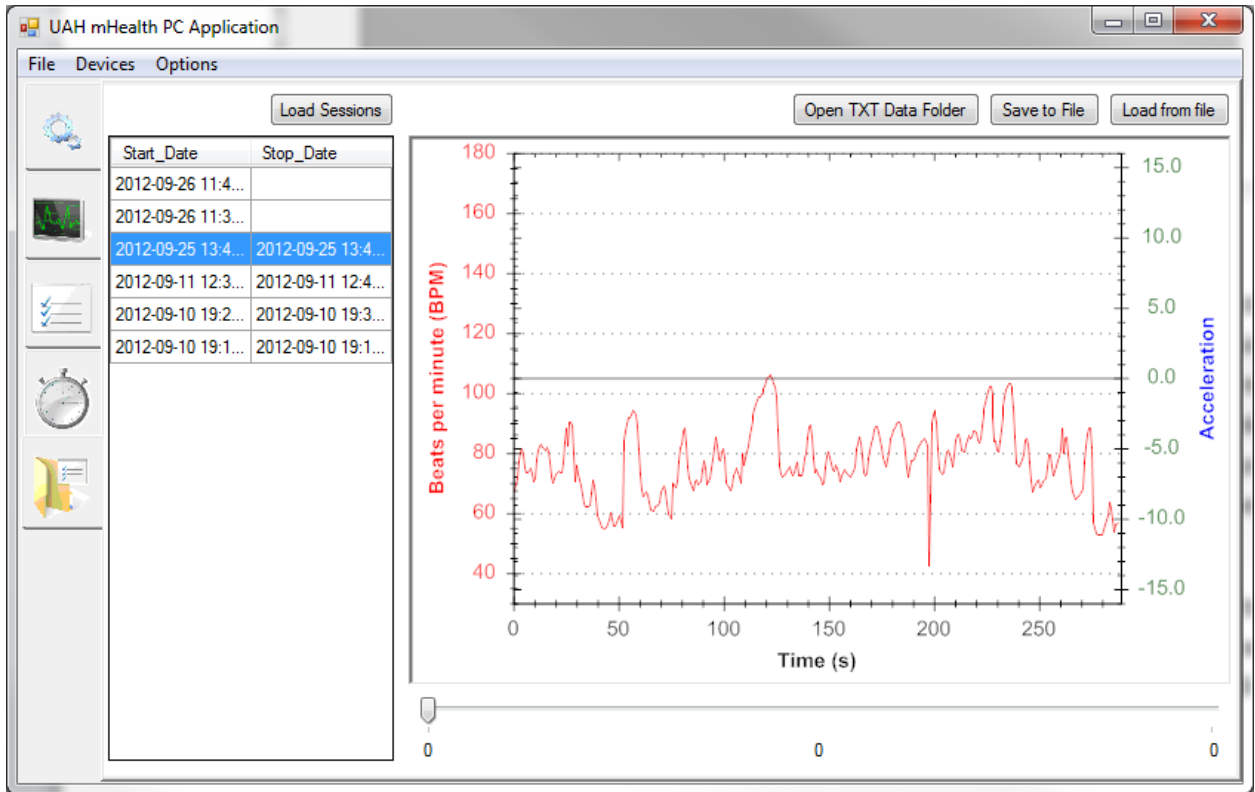


Figure 9 View Old Sessions

Pressing the *Load Sessions* button loads all sessions for the user from the server. A valid username and password must be entered in the *Database Connection* settings to load data from the server. Loaded data on the graph can be saved in a text file by clicking the *Save to File* button. Saved text files can be loaded by clicking the *Load from file* button. To view the folder containing the saved text files, click the *Open TXT Data Folder* button.

3 A Sample Walkthrough

This section serves as an example walkthrough of how the application can be used. Before starting, Make sure that the Zephyr sensor is powered on and is worn properly before continuing.

First, configure the application by setting parameters on the *config* tab. Check the *Use Protocol* box to enable the use of a protocol to be set later. For Zephyr settings, check to *Breathing*, *RR Intervals* and *Acc Data* boxes. For Database settings, check the *RR Intervals* box and enter in a valid mHealth server username and password. When all of these options are checked, they should appear as shown in Figure 10 .

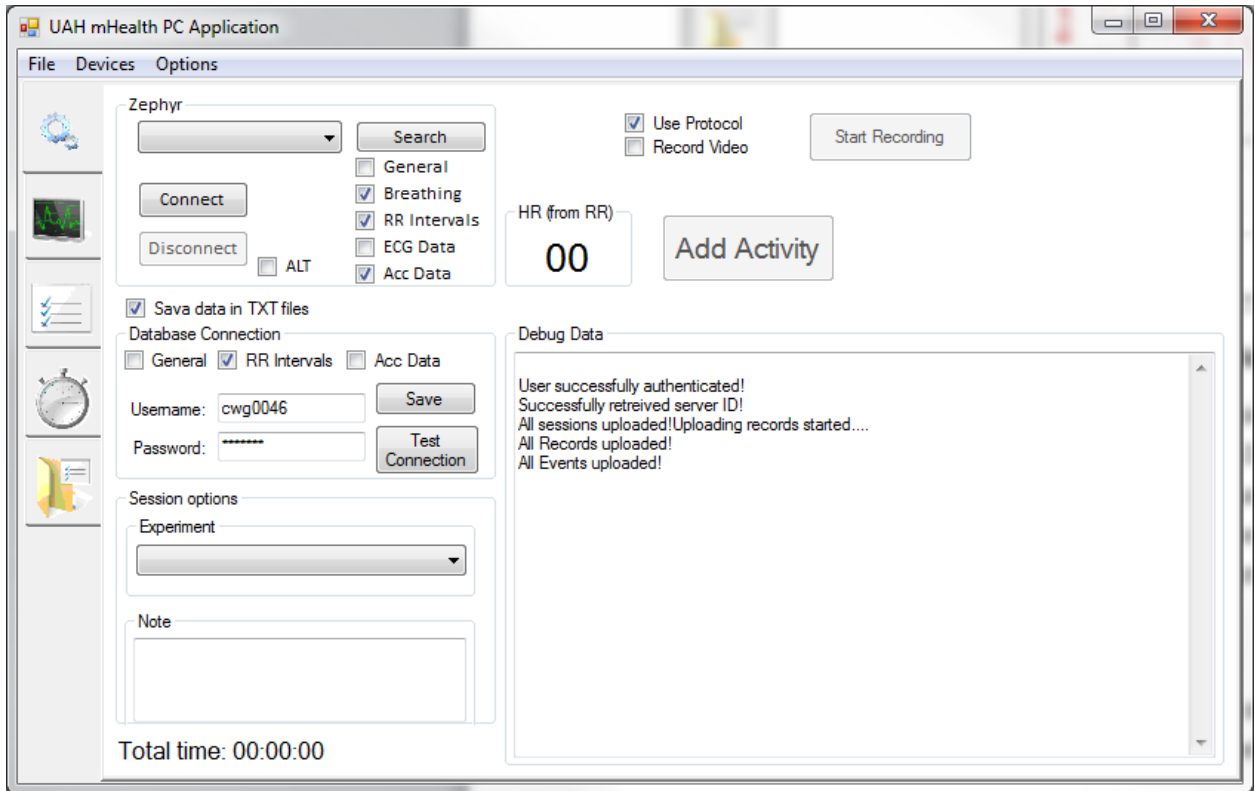


Figure 10 Config Settings for Walkthrough

Once settings are configured, search for Bluetooth devices by clicking *Search*. All nearby Bluetooth devices will appear in the dropdown menu. Select the Zephyr sensor (named BH BHT001527 in this walkthrough) and click *Connect*.

Once the application is connected to the sensor, verify that the application is monitoring all selected sensor data by navigating to the *Display Live Data* tab. Check the boxes next to *HR (RR Intervals)*, *Breathing Waveform* and *Accelerometer Data*. Also, click the *Accelerometer Data* label to change its color to green, mapping it to the second Y-axis. Once complete, a graph similar to Figure 11 below should appear.

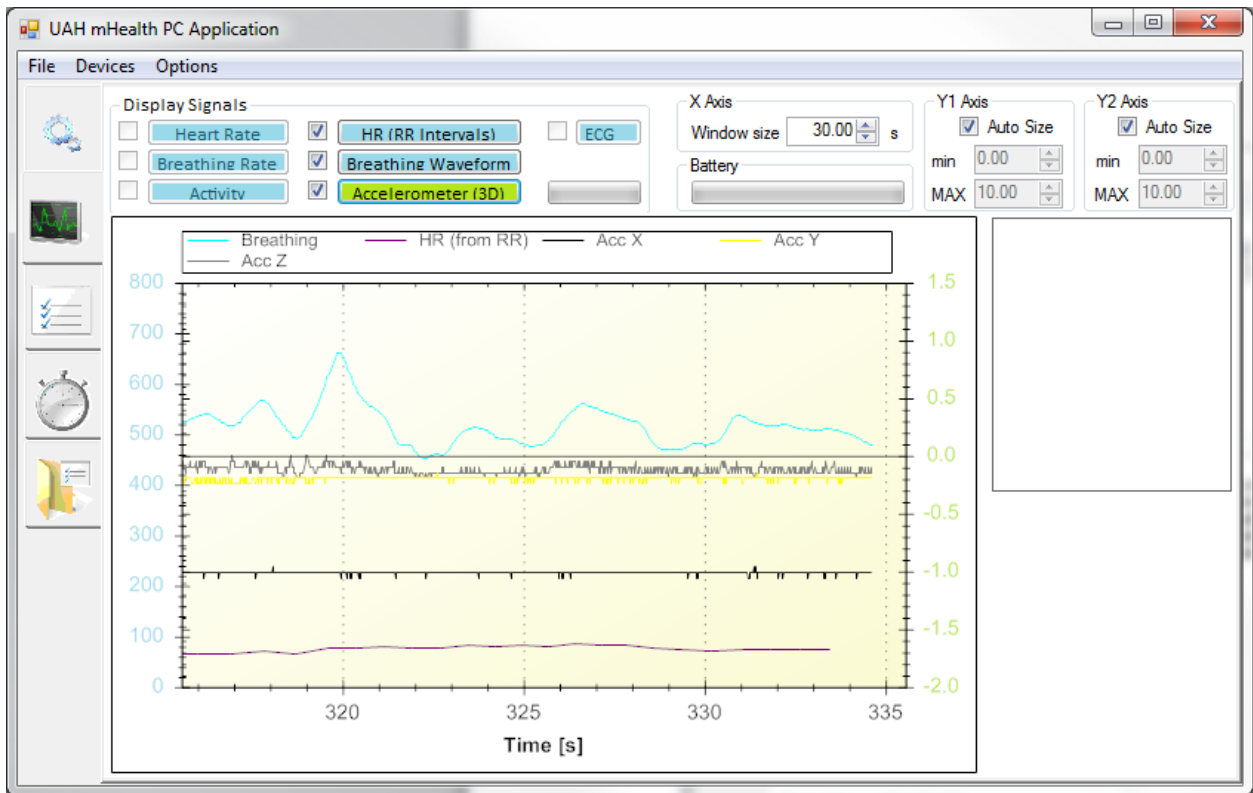


Figure 11 Live Session Display for Walkthrough

Next, navigate to the *Define Protocol* tab. Define the protocol as shown in Figure 12. This protocol will be used during the session.

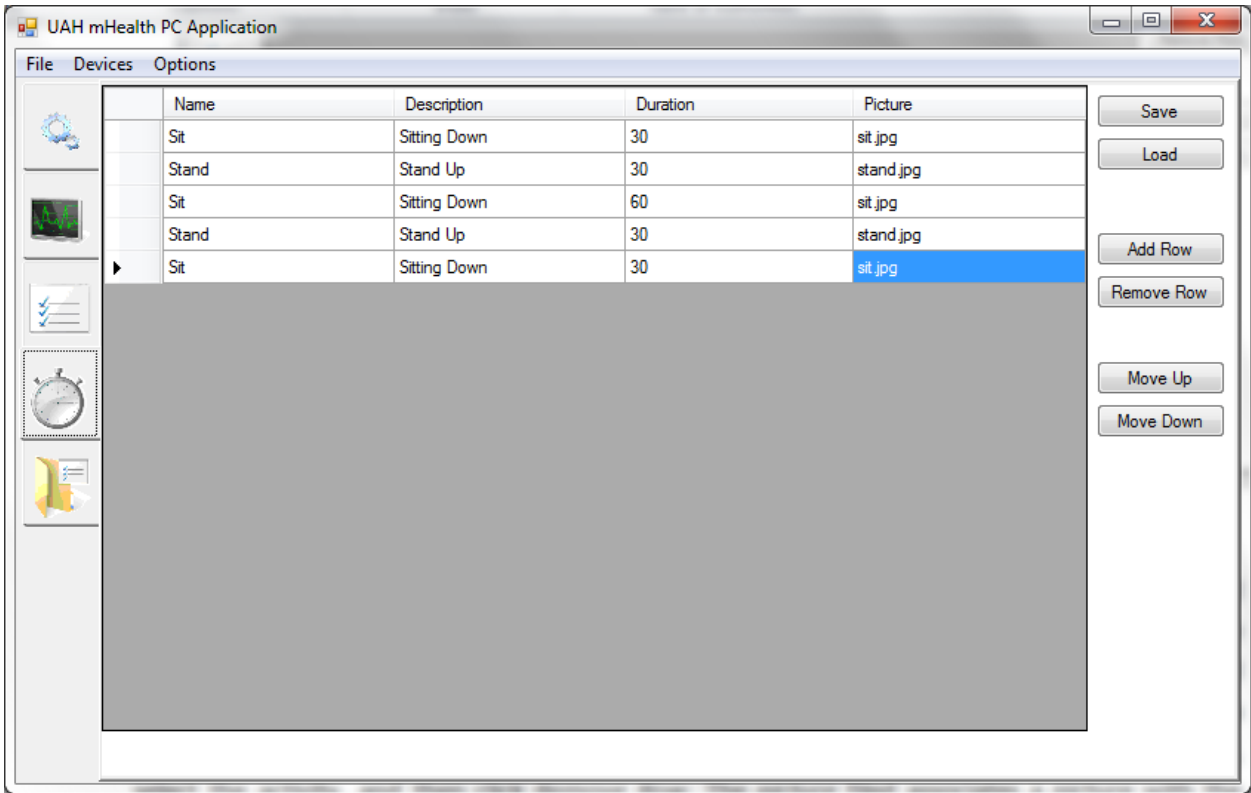


Figure 12 Defined Walkthrough Protocol

Press the “Add Row” button five times and fill each row with the information above in Figure 12.

To save this protocol, click the “Save” button and choose a name for the protocol, such as *example_protocol.txt*. Again, this protocol will be the one used during the session. Upon successfully saving the file, the dialog shown below in Figure 13 should appear. Click “Ok” to close the window.

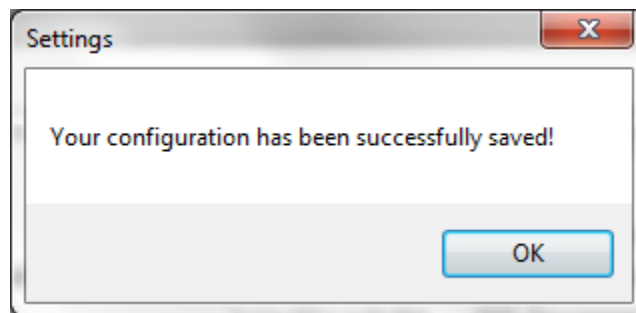


Figure 13 Save Confirmation Dialog

Now that the protocol has been defined, navigate back to the *Config* tab and press “Start Recording.” Upon pressing, the *Protocol* window, shown below in Figure 14, will appear. The person wearing the Zephyr sensor should sit down at this time.

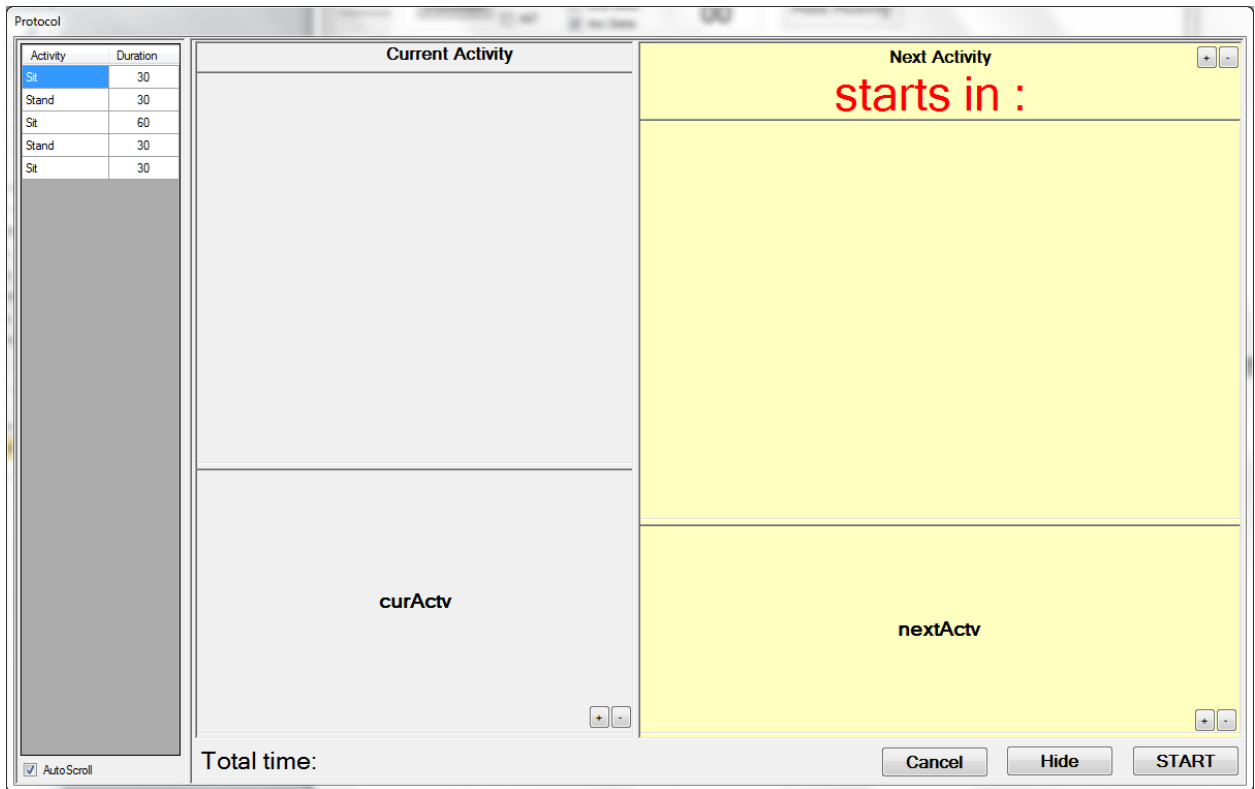


Figure 14 Protocol Window

The defined protocol is shown in the leftmost portion of the *Protocol* window. The name of the current activity is shown in the lower grey portion of the window, and the next activity is shown in the lower yellow portion of the window, as well as the remaining time until the next activity begins, displayed in red text in the upper yellow portion of the window. Verify that the displayed protocol matches the one in Figure 14. Read the following paragraph before clicking the “START” button to start recording data from the Zephyr sensor.

As shown in Figure 15 below, the first current activity, “Sit” is the first activity in the protocol and thus will appear as the current activity. The “Stand” activity appears as the next activity to be performed. The time remaining will start counting down from 30 seconds, the length of the “Sit” activity. Once it reaches 0, the “Stand” activity will become the current activity. At this time, the person wearing the Zephyr sensor should stand up. Now, “Stand” is displayed as the current activity and “Sit” is displayed as the next activity. Follow the protocol to completion, performing the next activity displayed while the timer is counting down when the timer reaches 0. When the current activity is the last activity to be performed, “Current Activity is the last” will be displayed as the next activity, as shown below in Figure 16.



Figure 15 Protocol Window during Active Recording Session

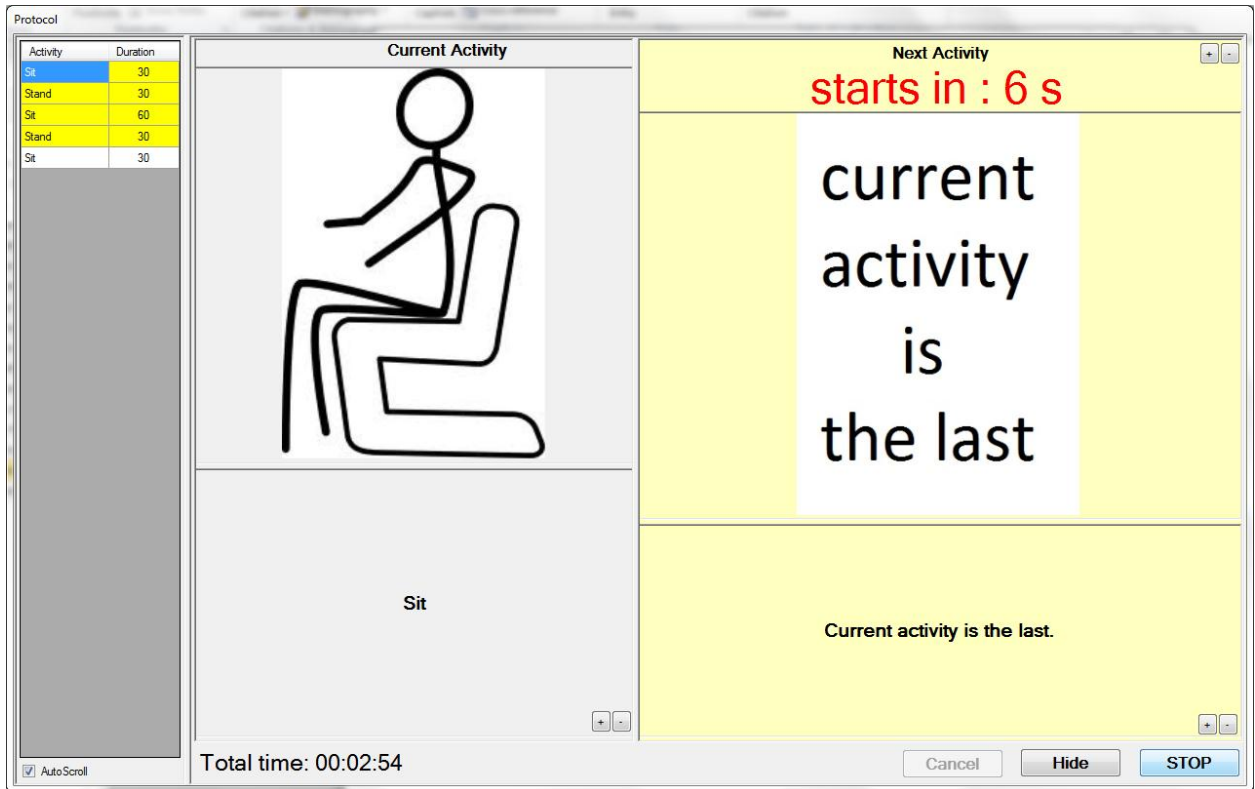


Figure 16 Protocol Window during Last Activity

After the recording session ends, the data can be downloaded from the server and displayed by navigating to the *View Old Sessions* tab and clicking the “Load Sessions” button. Clicking this button will download all data from the mhealth server associated with the user whose credentials were entered in the *Database Connection* settings on the *Config* tab. The most recent session, the one in this walkthrough, will be located at the top of the list with the date the recording session in this walkthrough was performed, shown below in Figure 17. Note that it may take a while for the recent session to appear in the list. If the data does not appear in the list, navigate to the *Config* tab and click the “Test Connection” button. Afterwards navigate back to the *View Old Sessions* tab and once again click the “Load Sessions” button. The recently recorded session should now appear in the list.

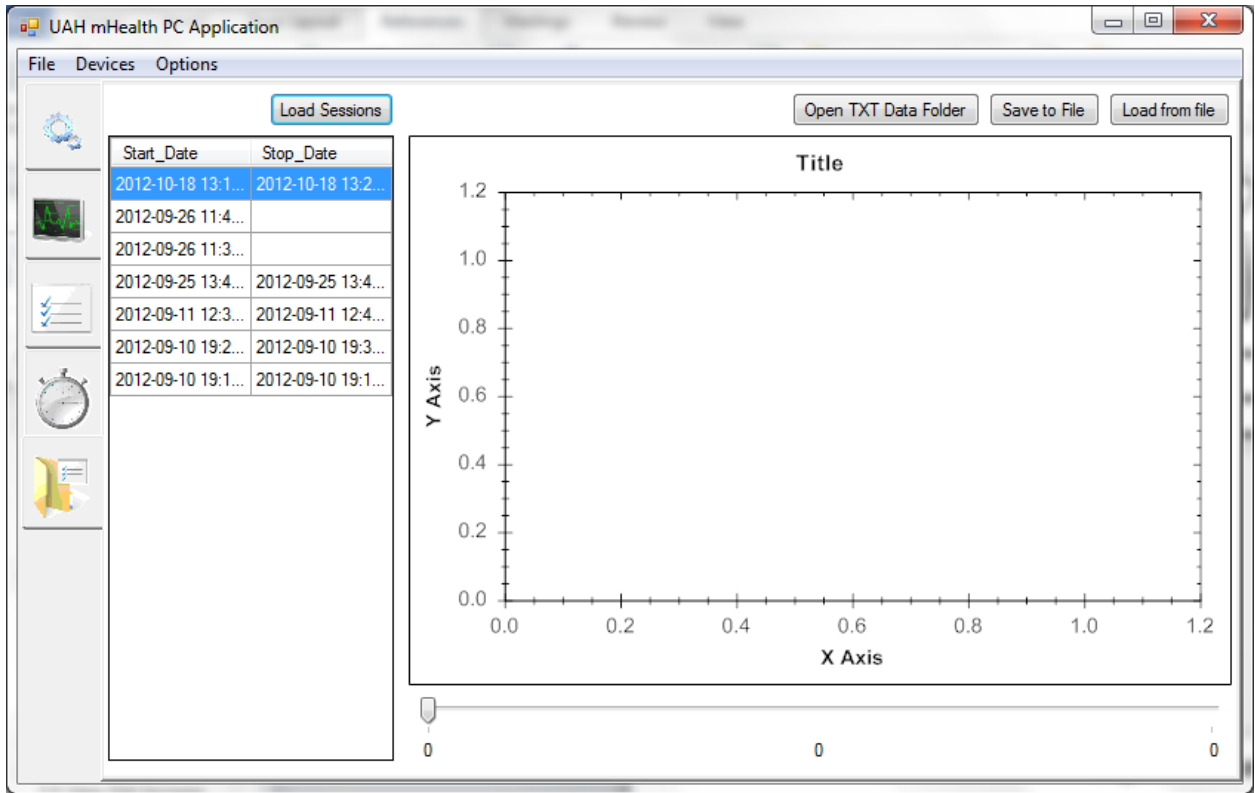


Figure 17 Loaded Sessions from mhealth Server

Double-clicking the most recent session displays the data from that session onto the graph, shown below in Figure 18. Since in this walkthrough only *RR Intervals* was selected to be uploaded, only heart beats per minute will be displayed on the graph.

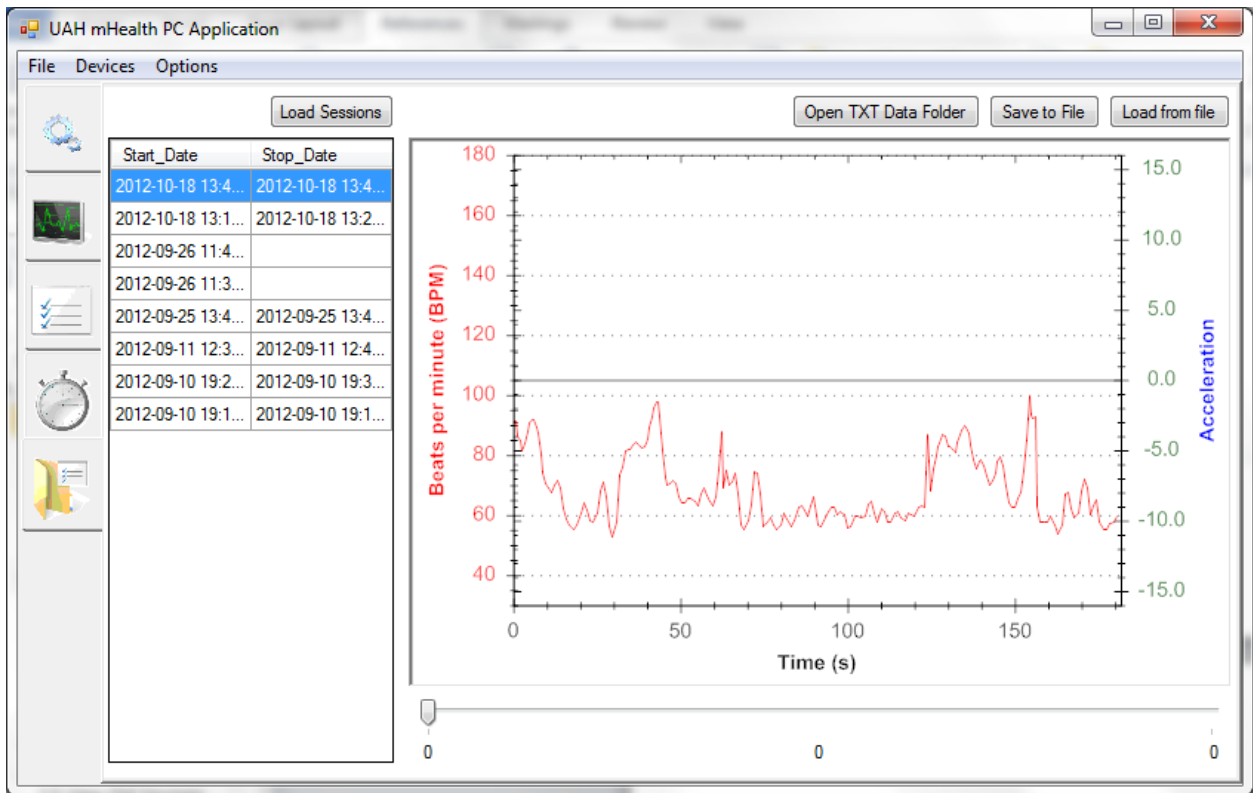


Figure 18 Displayed Session Data from mhealth Server

4 Troubleshooting

This section serves as a reference to common problems encountered while using the application.

I cannot connect to the Zephyr Sensor

Make sure that the Zephyr sensor is powered on and that Bluetooth is enabled on the computer. Additionally, it may be necessary to first pair the sensor with the computer before using it with the application.

I cannot connect to the online database

Make sure that a valid username and correct password have been entered.

The Zephyr sensor is not listed when searching for devices

The sensor needs to be paired with the computer. To pair the sensor with the computer, go to the Control Panel and look for a "Bluetooth Setting" options.

The application is not monitoring or recording specified data

The sensor data the application is to monitor needs to be selected before connecting to the sensor. To change settings, first disconnect from the device, change settings to desired sensor data and reconnect.

I cannot start a recording session

A recording session can only be initiated when the application is connected to the Zephyr sensor. Please check that the application is connected to the Zephyr sensor.