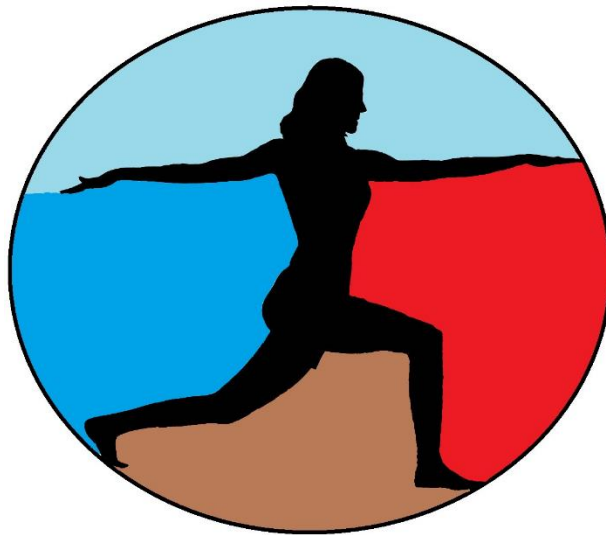


# **E**lemental **K**inection



## User Manual

Version 2.1

2 May 2016

## Revision History

All revision history listed below.

Version	Change Summary	Date
1.0	<ul style="list-style-type: none"><li>• Initial Draft</li></ul>	24 February 2016
2.0	<ul style="list-style-type: none"><li>• Updated screenshots to reflect changes in the application</li><li>• Updated user steps to reflect alterations in program flow</li></ul>	24 April 2016
2.1	<ul style="list-style-type: none"><li>• Minor formatting</li></ul>	2 May 2016

## Revision Sign Off

The following asserts that all team members have read the document and asserts that the information contained within this document is complete and correct.

Name	Signature	Date
Samuel Kent		
Jack Kempner		
Nathan Johnson		
Aakash Tyagi		

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# 1 Introduction

## 1.1 Purpose

The purpose of this document is to provide the users of the Elemental Kinection system a guide for setup and operation. Many parts of the document will be broken up into two types of users. The first type of user is the patient. The patient, for the purpose of this document is the user who is setting up Elemental Kinection for the use of completing therapy sessions and recording the results. The second type of user is the therapist. For the purpose of this document the therapist is the user responsible for recording new exercises, assigning therapy sessions and evaluation results.

## 1.2 Project Overview

The Elemental Kinection project aims to utilize several technologies and tools focused around the Microsoft Kinect v2 to provide a new adaption of telerehabilitation. Telerehabilitation seeks to make it easier on patients who cannot consistently travel to the location of the therapist to complete therapy sessions. It allows them to complete therapy sessions remotely and within the comfort of their home. Specifically Elemental Kinection leverages Microsoft Visual Gesture Builder to make it easier for therapists to add exercises to the program's catalog without the need for programmers to heuristically code the new exercises.

## 1.3 Overview of Document

- Section 2** – System Components
- Section 3** – Setup and Installation
- Section 4** – System Walkthrough
- Section 5** – Glossary of Terms

## **2 System Components**

Elemental Kinection is comprised of three distinct components: the Microsoft Kinect v2, the patient desktop application, and the online website application.

### **2.1 Microsoft Kinect v2**

The Microsoft Kinect v2 is the primary data source for Elemental Kinection. Due to the large amount of data that it collects on user interaction and transmits to the desktop PC, it requires a dedicated USB 3.0 port.

### **2.2 Patient Desktop Application**

The desktop application resides on the patient PC, which must have at least the following system requirements:

- Windows 8 or greater
- 64-bit processor 3.1 GHz or higher
- 4 GB of RAM or more
- DX11 capable GPU

This application accepts the data from the Kinect v2 and relays exercise results to the web application, as well as downloading session and exercise information from the web application.

### **2.3 Web Application**

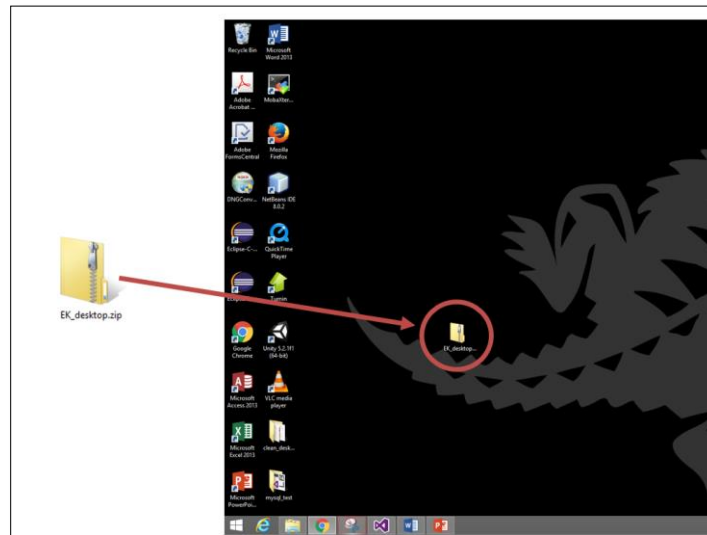
The web application allows a therapist to create sessions, upload new exercises, and view patient exercise results.

It transmits session and exercise data to the desktop application and receives session results from the desktop application.

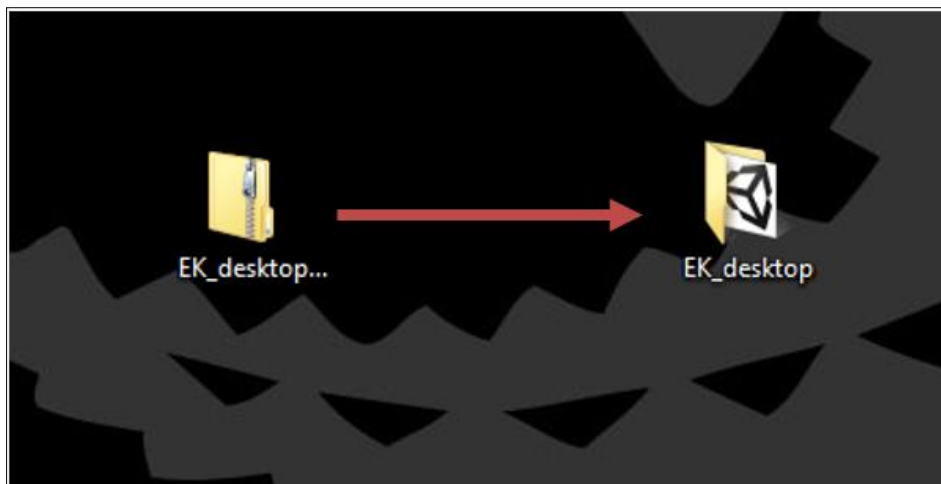
### 3 Setup and Installation

#### 3.1 Patient Setup

1. Obtain a .zip file from your therapist that contains the **elemental\_kinection.exe** file and the **elemental\_kinection\_data** folder.



2. Connect your PC to the Internet if it is not already. If you have not already done so connect the Kinect v2 to your PC and allow it time to download and install drivers. Keep in mind your PC must meet the specification described above.
3. Unzip the .zip file with the executable and data folder on to the desktop or file location of your choosing.

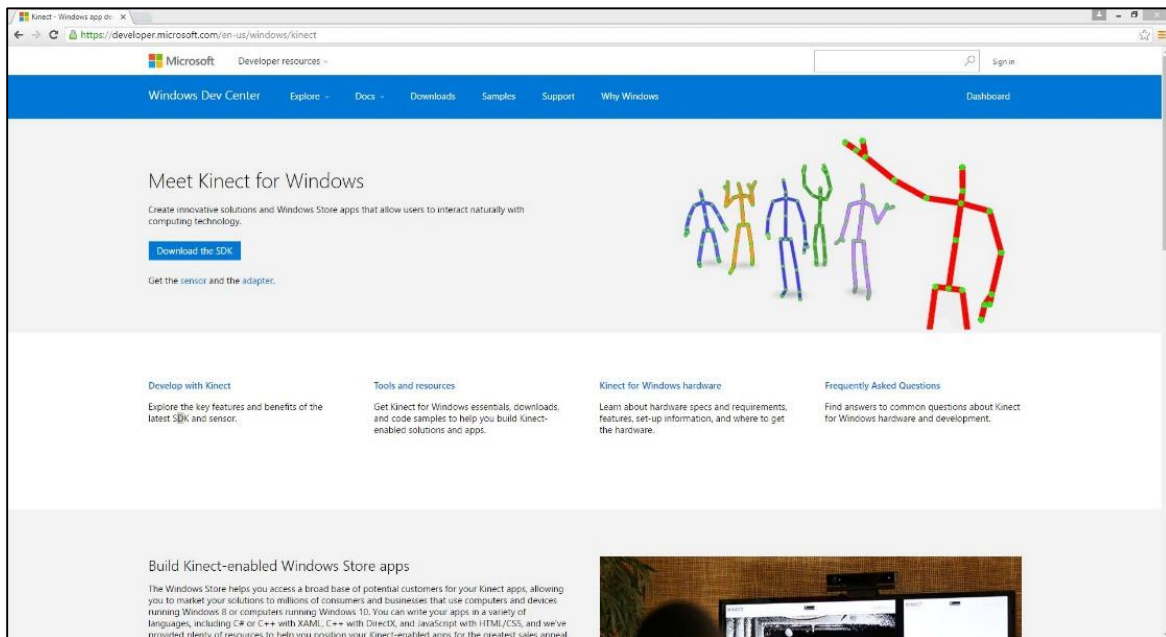


4. Verify that you are connected to the internet navigate into the folder and double click the executable then double click the **elemental\_kinecton.exe** file to run the application.



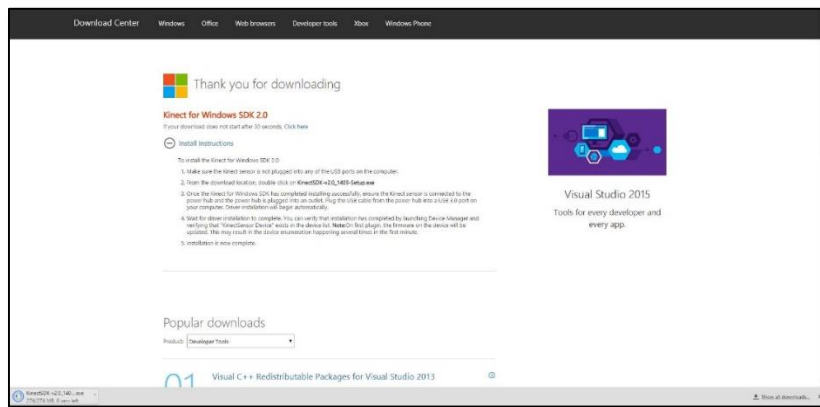
### 3.2 Therapist Setup

1. To acquire Microsoft Visual Gesture Builder and Kinect Studio download the Kinect v2 SDK from the following link: <https://developer.microsoft.com/en-us/windows/kinect>  
The link should take you to a site that looks similar to the one below.

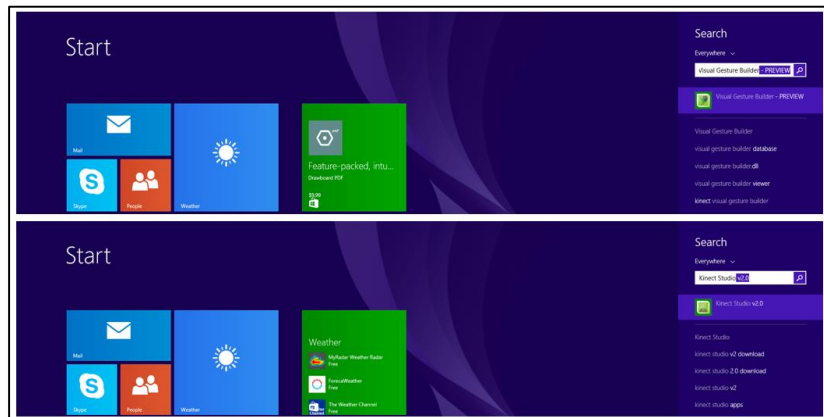




2. Click the “Download the SDK” button. A download should start. Run the executable and follow through the instructions.



3. Once you have downloaded the Kinect SDK, Visual Gesture Builder and Kinect Studio will be installed. The default download path: C:\Program Files\Microsoft SDKs\Kinect\v2.0\_1409\Tools\KinectStudio. Alternatively you can search for Visual Gesture Builder or Kinect Studio with the Windows search tool.



There is no additional setup to use these tools.

4. If you have not already, plug the Kinect v2 into the Kinect for Windows Adapter and then plug the adapter into a power socket and a USB 3.0 or higher port in the PC. Wait for the Kinect Drivers to install automatically.

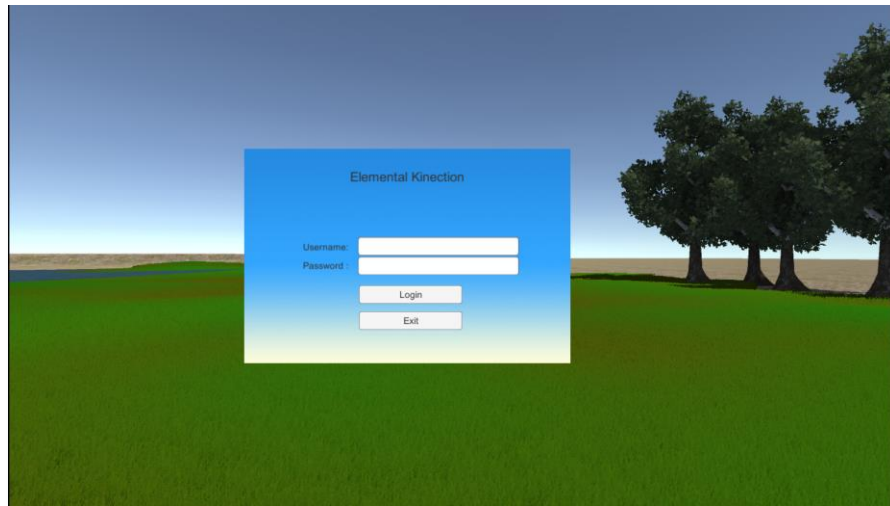
If you have any additional trouble up to this point you can check the official Microsoft forum at:

<https://social.msdn.microsoft.com/Forums/en-US/home?forum=kinectv2sdk>

## 4 System Walkthrough

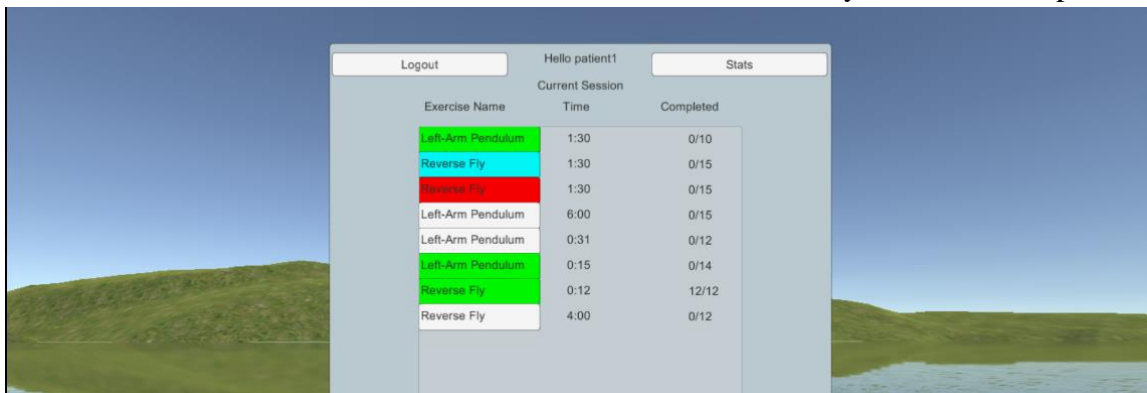
### 4.1 Patient Walkthrough

1. Double click the executable mentioned in the setup portion above and a **Login Page** opens.



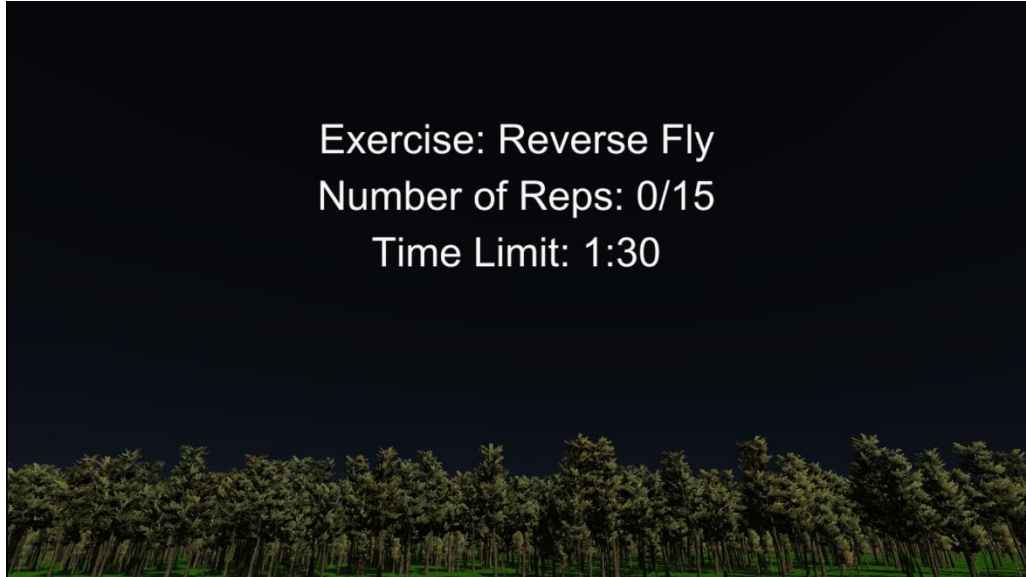
2. Enter the username and password given to you by the therapist and hit the “Login” button.

3. The **Session Page** will open displaying the exercises due in your current session. Exercises that can be completed at will are displayed in white. If an exercise has already been completed it will be colored **green**. Exercises that are part of a sequence will displayed in either **cyan** if they are the next exercise to be completed or **red** if the exercise has yet to be unlocked. Exercises in a sequence must be completed and unlocked in a specific order. To select an exercise click on the button with the name of the exercise you wish to complete.

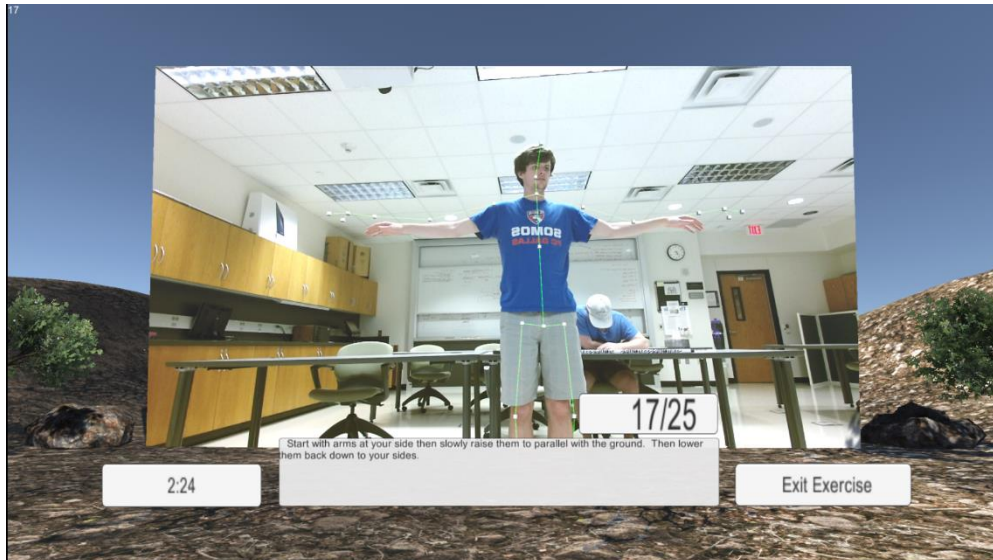


If the session information does not appear, check the desktop’s internet connection, ensure the connection is established, and restart the Elemental Kinection application.

4. When an exercise is selected, you will be directed to the **Exercise Page**. An **Introduction Page** should be displayed prior with the name of the exercise, the number of reps to be completed and the time limit for completion of the exercise.



5. The **Exercise Page** will automatically return to the **Session Page** and save your results when you either complete the assigned number of reps or time runs out. You can exit prematurely at any time by clicking the “Exit Exercise” button which will also take you back to the **Session Page**.



6. To view the results of past exercises click on the “Stats” button in the upper right of the **Session Page**. This will take you to the **Stats Page**.



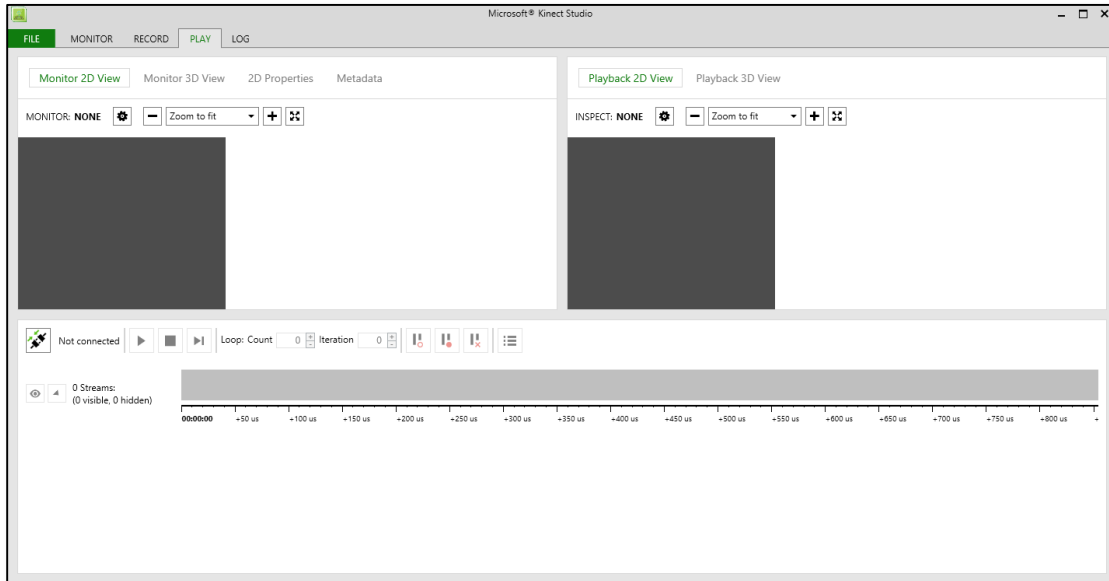
7. The statistics that are kept by Elemental Kinection are the number of reps completed for a specific exercise for a specific session due date, and the amount of time it took to complete a specific exercise also for a specific session due date. The sequence for viewing statistics is as follows:

- a) Select the range of session dates for which you would like to view results from the dropdown menu along the top.
- b) Select either the “Reps Completed” or “Time Completed” button depending on what results you would like to view. “Reps Completed” will show the total number of repetitions completed of a type of exercise in a session and “Time Completed” will show the total elapsed time to complete a type of exercise in a session. The button should turn **green** when pressed.
- c) Select the exercise button from the left that corresponds to the exercise you wish to see.

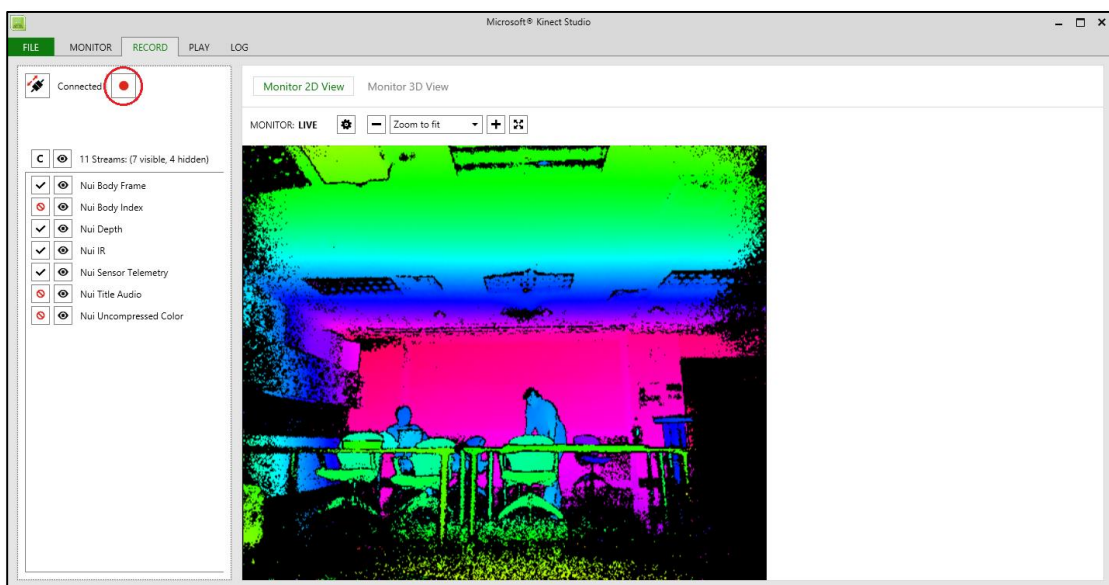
## 4.2 Therapist Walkthrough

### 4.2.1 Creating New Exercises

1. To begin creating .gbd exercise files for upload to the website, launch Kinect Studio.



2. After ensuring that the Kinect is properly connected to the desktop, select the record tab and hit the recording button. Then perform the desired exercise in front of the Kinect. This exercise should be performed by multiple people with differing body types and about fifteen repetitions per person for best results.

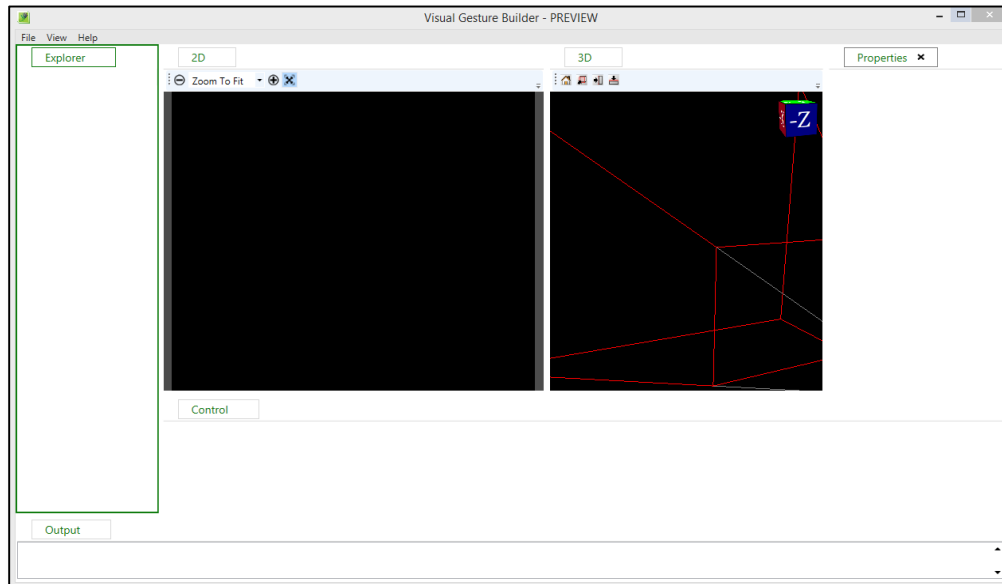


Once you're satisfied with your recording press the record button again and Kinect Studio will automatically save your file in:

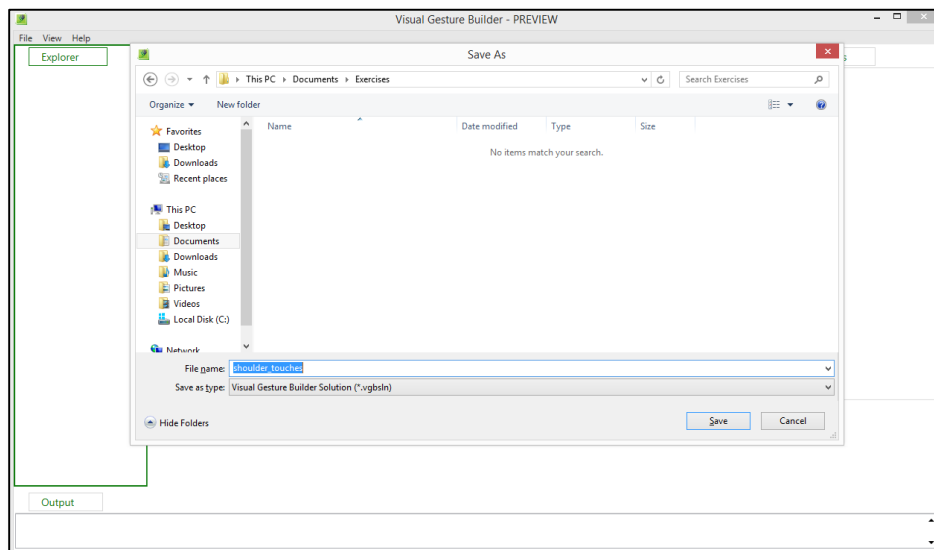
\\...\Documents\Kinect Studio\Repository

It is recommended that you rename the generated video files so as to more easily keep track of which files to use in the next part.

**3.** With the desired exercise recorded, Kinect Studio **must** be closed before you open Microsoft Visual Gesture Builder.

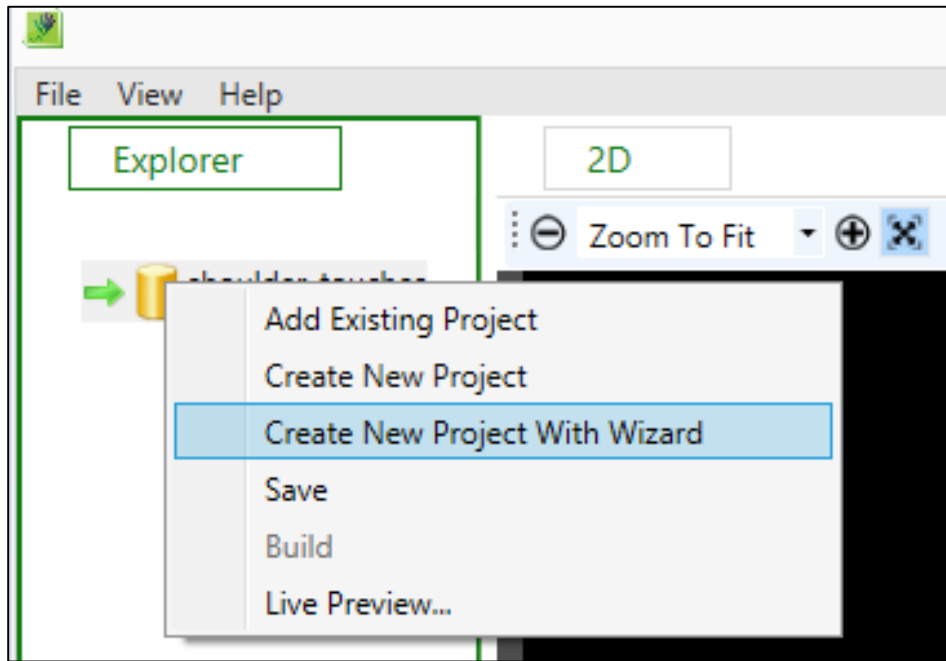


Now that you have opened Microsoft Visual Gesture Builder, select File->New Solution and save a new Visual Gesture Builder Solution.



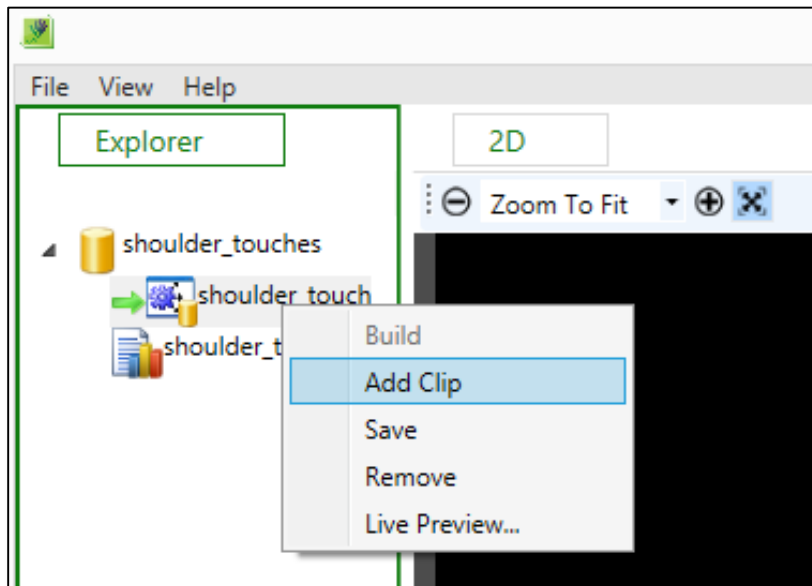


4. After you have saved the solution you'll be working on, right click on the solution and click Create New Project With Wizard.

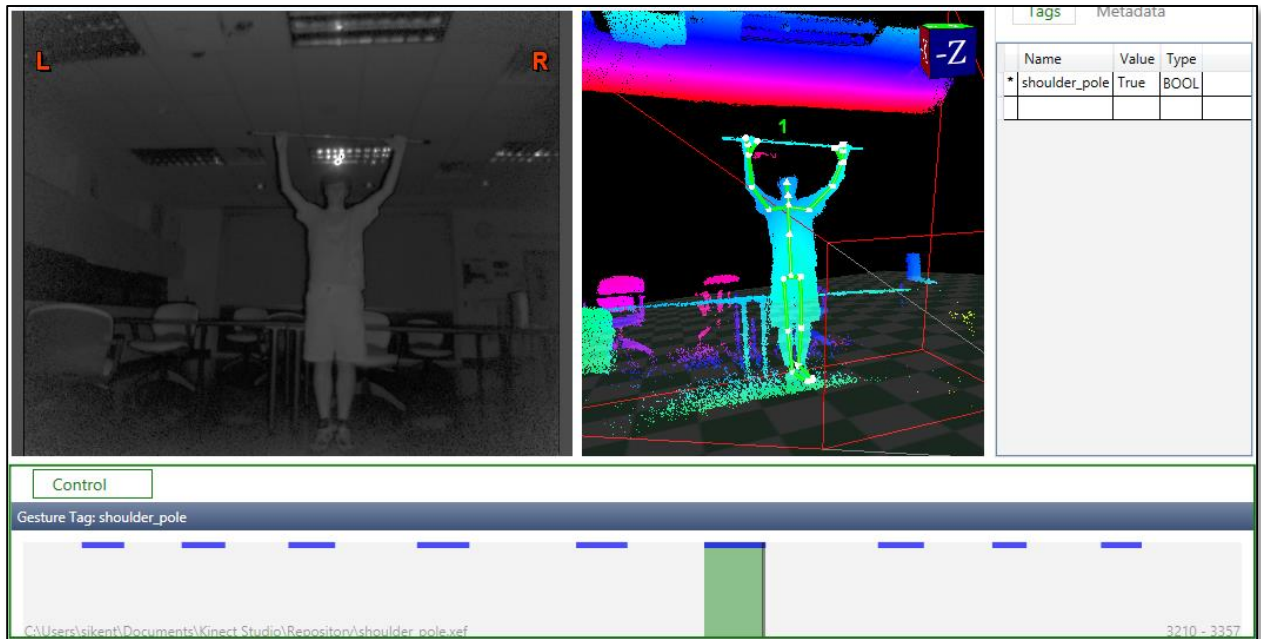


The wizard will then guide you through the steps of creating a new project.

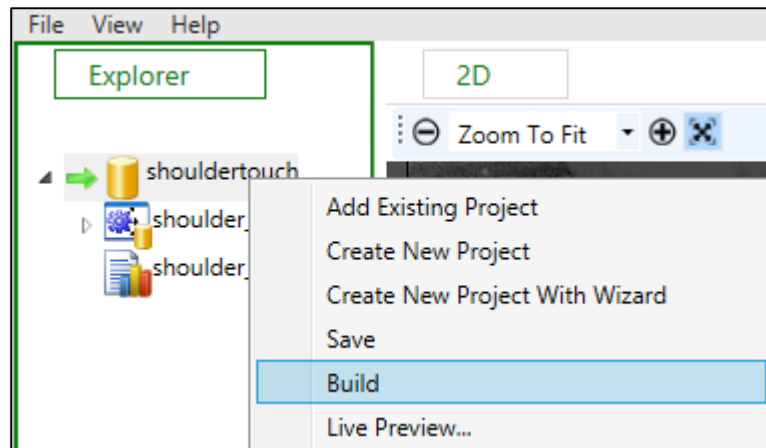
5. When you are finished setting up a new project, right click on the generated project file and upload the clip(s) that were created by Kinect Studio.



6. Navigation through the clips is performed via the arrow keys. To “tag” a gesture correct, the hold the shift key while navigating through the appropriate portions of the clip. Hit enter once the gesture is complete and repeat for all the gestures in the clip(s).



7. After you have finished tagging all of the appropriate portions of the clip(s), right click on the solution and hit “build”. This will provide the .gbd file that will be uploaded to the website.



For a more in depth walkthrough, please view the following link:

<https://channel9.msdn.com/Blogs/k4wdev/Custom-Gestures-End-to-End-with-Kinect-and-Visual-Gesture-Builder>

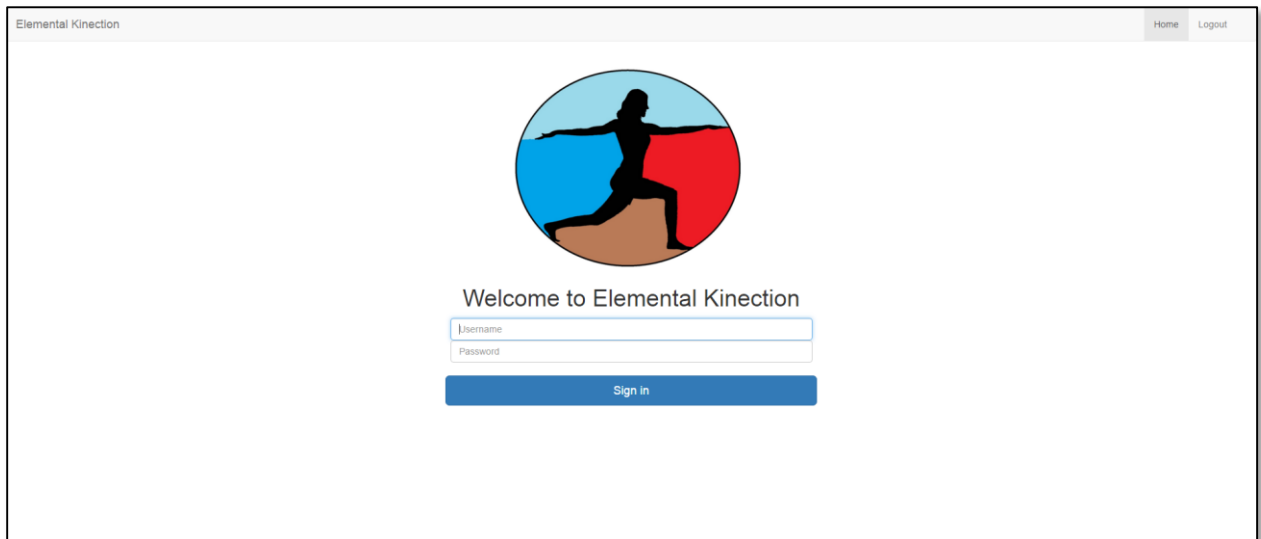


## 4.2.2 Uploading Exercises

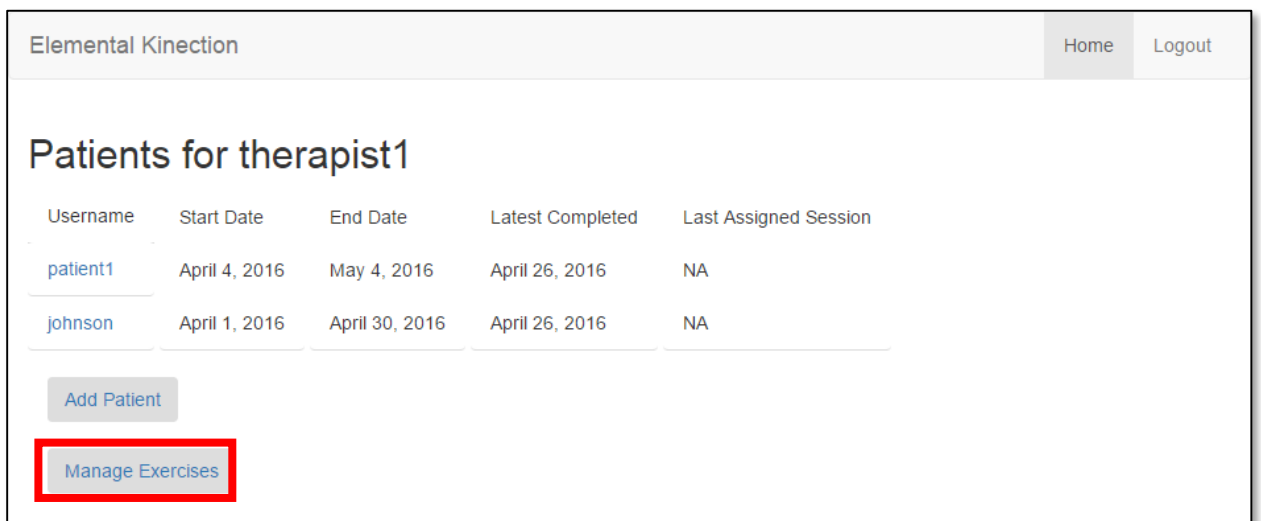
1. Now that you have your .gbd file, you are ready to upload a new exercise to the web application.

Start by navigating to the web portal at:

<http://ec2-52-36-159-123.us-west-2.compute.amazonaws.com:8000/>



2. After you log into the website as a therapist, you will be presented to your home page. Select the "Manage Exercises" button near the bottom of the page.



3. You will then be directed to the Exercise List screen. Select the “Add Exercise” button to add a new exercise in the database.

The screenshot shows the 'Exercise List' interface. On the left, there is a 'Patient List' tab and a list of exercises under 'All Exercises:'. The exercises listed are: Shoulder Touch, Right Hip Adduction, Squat, Reverse Fly, Left-Arm Pendulum, Right-Arm Pendulum, Left Hip Adduction, Left Lunge, Right Lunge, Pole Mobility Shoulder Lift, Right Hop Forward, and Left Hop Forward. At the bottom left of this list is an 'Add Exercise' button. On the right side of the screen, there is a form for adding a new exercise with the following fields: Exercise: (with a sub-label 'Name:'), Category:, Added by:, Date:, and Description:.

4. Input the exercise information. It is **imperative** that you input the .gbd name **precisely** the same as the file name that you are uploading.

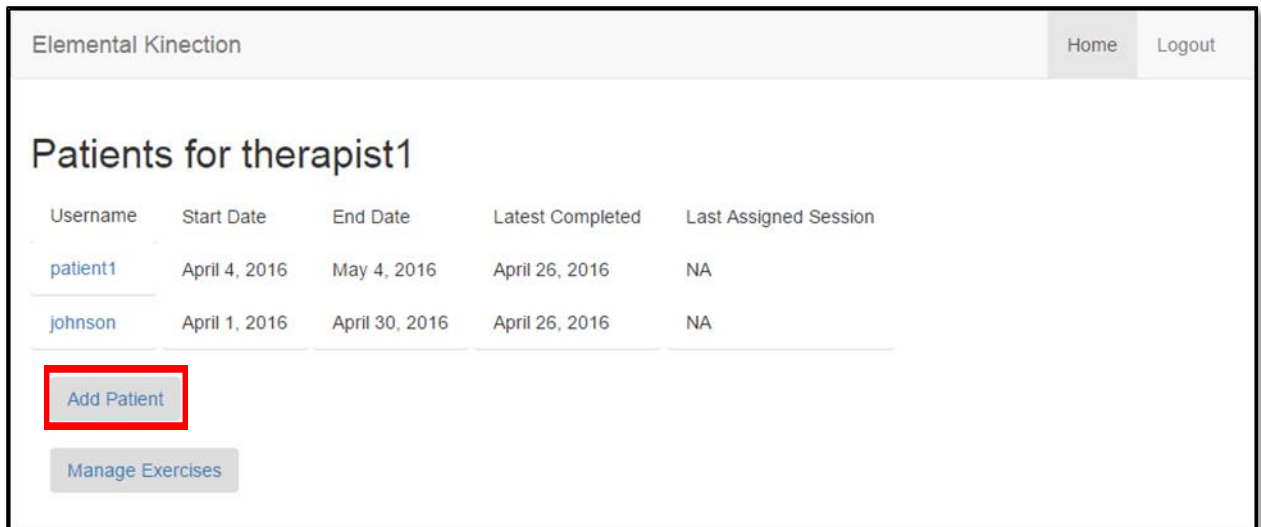
The first screenshot shows the 'Add a new exercise' form. It has a 'Patient List' tab and the following fields: Exercise Name (filled with 'Pole Mobility Shoulder Lift'), Category (filled with 'Shoulder'), Description (filled with 'Grasp a pole with both hands and let both arms hang limp at your sides. Then, u:'), and Gbd name (filled with 'shoulder\_pole.gbd'). Below the Gbd name field is a note: 'Enter your gbd filename. For example, if your file is named: "shoulder-touch.gbd", you must enter "shoulder-touch.gbd"'. At the bottom is a 'Proceed to upload' button.

The second screenshot shows the 'Upload a new exercise' dialog. It says 'Select a file: max. 10 megabytes' and has a bullet point: 'This field is required.' Below this are two buttons: 'Choose File' (with the text 'No file chosen' next to it) and 'Upload file'.

You should now see your new exercise in the exercise list.

### 4.2.3 Creating a Patient Account

1. Once you have finished uploading exercises, return to the main screen. To create a new patient, select the “Add Patient” button.

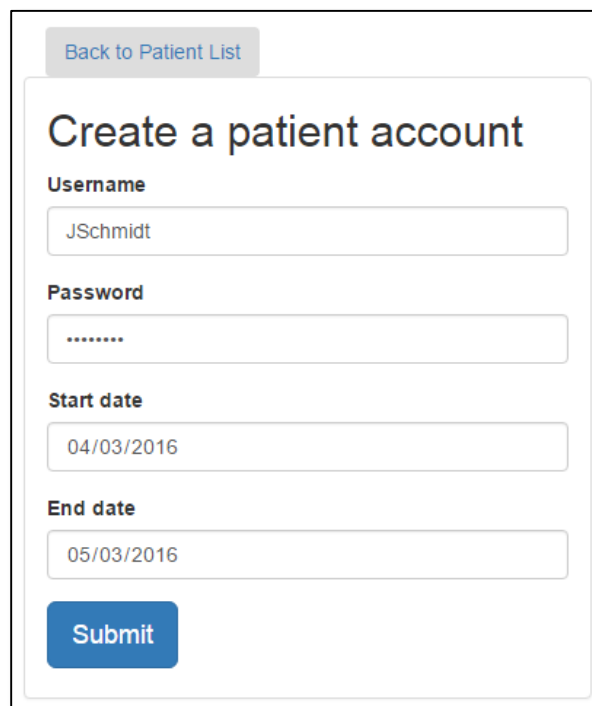


Username	Start Date	End Date	Latest Completed	Last Assigned Session
patient1	April 4, 2016	May 4, 2016	April 26, 2016	NA
johnson	April 1, 2016	April 30, 2016	April 26, 2016	NA

[Add Patient](#)

[Manage Exercises](#)

2. This will bring you to a screen where you will be able to input the patient’s information. The password should be saved in a secure location, as this password is what the patient will require to access the desktop application.



[Back to Patient List](#)

### Create a patient account

**Username**

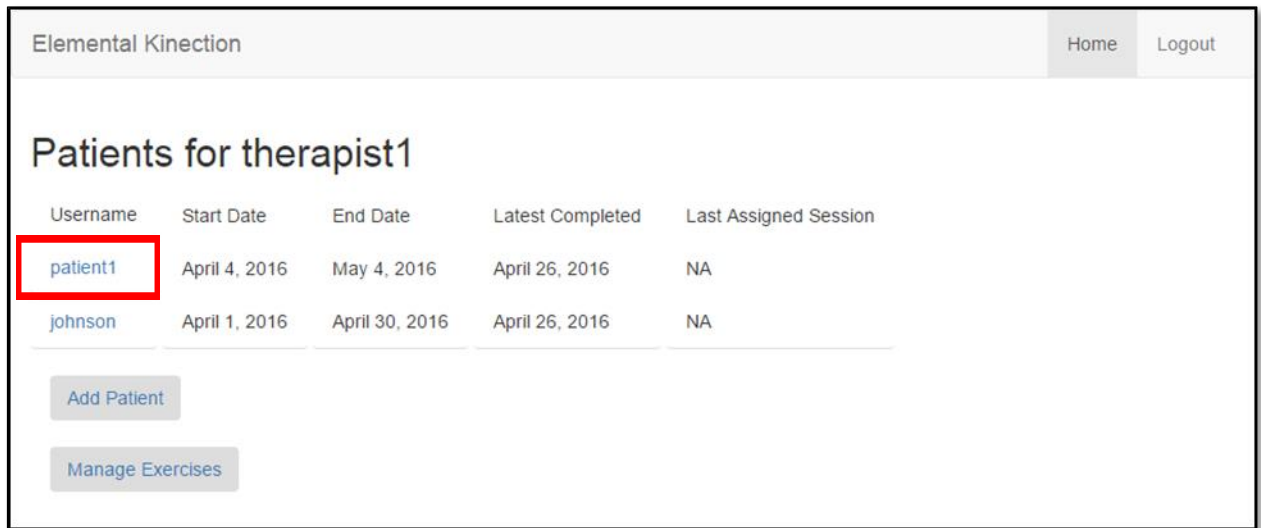
**Password**

**Start date**

**End date**

#### 4.2.4 Assigning Sessions

1. Now that you have a patient, you can assign a session. To start assigning a session to a particular patient, select that patient's name from the list of patients and navigate to the results page.



Elemental Kinection Home Logout

### Patients for therapist1

Username	Start Date	End Date	Latest Completed	Last Assigned Session
patient1	April 4, 2016	May 4, 2016	April 26, 2016	NA
johnson	April 1, 2016	April 30, 2016	April 26, 2016	NA

[Add Patient](#)

[Manage Exercises](#)

2. Since this patient is newly created, there will be no exercise results recorded and the graph will not display. Select the “Manage Sessions” button to assign a session.



Elemental Kinection

[Back to Patient List](#)

### patient1's Results

To see patient1's stats, select an exercise on the left.

**patient1's Exercises**

- [Reverse Fly](#)
- [Left-Arm Pendulum](#)
- [Shoulder Touch](#)

3. This page shows all the sessions currently assigned to the patient. To assign a session, navigate to the new session page and fill out the necessary information.

### Sessions Assignment

\*select a session and add exercises **OR** create a new session

Current sessions for patient1

Back to Results
Create New Session

**April 26, 2016**

Exercises in this session:

- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 12 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.
- Reverse Fly, 10 reps, 120 sec.

**April 24, 2016**

Exercises in this session:

- Shoulder Touch, 10 reps, 60 sec.
- Left-Arm Pendulum, 5 reps, 90 sec.
- Reverse Fly, 25 reps, 30 sec.
- Reverse Fly, 50 reps, 88 sec.
- Shoulder Touch, 5 reps, 60 sec.

Continue assigning exercises until the session is complete. Exercises can be assigned to be completed in sequence. You start by assigning an exercise to be the first of the sequence. You can then define exercises after that to be part of that sequence. Those exercises will be progressively unlocked as the patient goes through the sequence.

View Sessions

**Current exercises for patient1 due on May 3, 2016**

Exercises	Reps	Time (Sec.)
Left Hip Adduction	15	120
Reverse Fly	10	150

#### Assign a new exercise for current session

**Exercise**

Left Lunge

**Total reps**

20

**Estimated time to complete (sec.)**

60

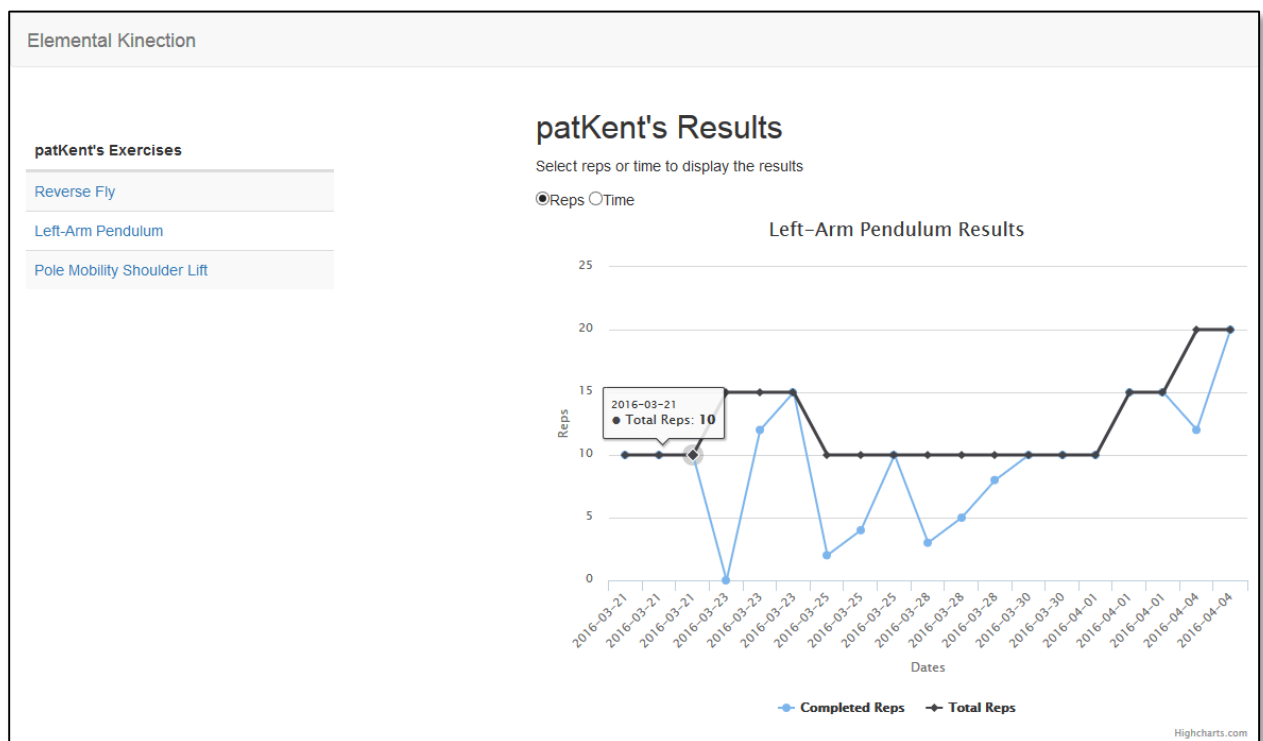
**Sequence**

Not in sequence

Assign

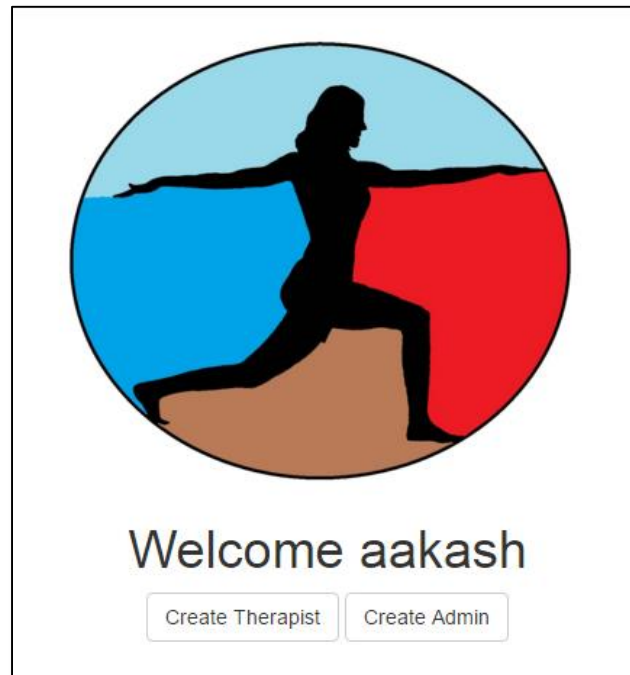
## 4.2.5 Viewing Results

1. To view the results of a patient's sessions, navigate to the home screen and select the desired patient's name. You will be presented with a list of exercises that have been completed. Clicking on one will display the exercise graph. This graph differs from the desktop application. The desktop application is capable of showing a range of specific session dates, but the website will show results from the entire range of therapy. The desktop application only shows the aggregation of repetitions or time elapsed for a type of exercise in a session. The web will plot a point for every instance of an exercise even if there are multiple instances of it in one session.



### 4.3 Admin Walkthrough

1. Upon logging in, you will be presented with a home screen. Select either button to create an account of the corresponding type.



### Create Therapist Account

**Username**

**Password**

**First Name**

**Last Name**

**Workplace**

### Create Admin

**Username**

**Password**

**Firstname**

**Lastname**

2. To manage to the database, open the following link:

<http://ec2-52-36-159-123.us-west-2.compute.amazonaws.com:8000/admin>

You will be presented with a list of the different tables in the database. Click on the table name to manage the table.

**Django administration**

**Site administration**

Authentication and Authorization

Groups	<a href="#">+ Add</a>	<a href="#">Change</a>
Users	<a href="#">+ Add</a>	<a href="#">Change</a>

Kinect\_App

<b>Exercises</b>	<a href="#">+ Add</a>	<a href="#">Change</a>
Patients	<a href="#">+ Add</a>	<a href="#">Change</a>
Resultss	<a href="#">+ Add</a>	<a href="#">Change</a>
Session exercisess	<a href="#">+ Add</a>	<a href="#">Change</a>
Sessions	<a href="#">+ Add</a>	<a href="#">Change</a>
Therapists	<a href="#">+ Add</a>	<a href="#">Change</a>

Recent Actions

**My Actions**

- [Session object](#)  
Session
- [Session object](#)  
Session
- ~~2016-04-26~~  
Results
- [Session object](#)  
Session
- [Session object](#)  
Session
- ~~2016-04-26~~  
Results
- [Session object](#)  
Session
- [Session object](#)  
Session
- [Session object](#)  
Session
- [Session object](#)  
Session
- ~~jones~~  
User

**Select exercise to change**

Action:   0 of 13 selected

<input type="checkbox"/>	Exercise
<input type="checkbox"/>	test
<input type="checkbox"/>	Left Hop Forward
<input type="checkbox"/>	Right Hop Forward
<input checked="" type="checkbox"/>	<b>Pole Mobility Shoulder Lift</b>
<input type="checkbox"/>	Right Lunge
<input type="checkbox"/>	Left Lunge
<input type="checkbox"/>	Left Hip Adduction
<input type="checkbox"/>	Right-Arm Pendulum
<input type="checkbox"/>	Left-Arm Pendulum
<input type="checkbox"/>	Reverse Fly
<input type="checkbox"/>	Squat
<input type="checkbox"/>	Right Hip Adduction
<input type="checkbox"/>	Shoulder Touch

**Django administration**

Home > Kinect\_App > Exercises > Pole Mobility Shoulder Lift

**Change exercise**

ExerciseName:

Category:

Desc:

Gbd name:   
Enter your gbd filename. For example, if your file is name

Added by:  [+](#)

~~Delete~~



## 5 Glossary of Terms

*Amazon Web Services* – A secure cloud services platform for compute power, database storage and content delivery.

*Django* - Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design.

*Kinect Studio* – Kinect Studio is a utility application that you can use to preview Kinect sensor array data, record and play eXtended Event File (XEF) files, control the timeline position, and select 2D or 3D views. Kinect Studio APIs enable you to develop custom tools, to record and play back body data using XEF files.

*Kinect v2* - A motion sensing input devices by Microsoft for PCs. Based around a webcam-style add-on peripheral, it enables users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures

*Kinect for Windows SDK 2.0* – A set of developer tools, tutorials, and an API reference put out by Microsoft for the development of Kinect v2 on Windows 8, 8.1 and Windows 10.

*MySQL* – A popular Open Source SQL database management system, developed, distributed, and supported by Oracle Corporation

*Nginx* - A free, open-source, high-performance HTTP server and reverse proxy, as well as an IMAP/POP3 proxy server. It provides load-balancing, security controls and other monitoring tools.

*Slack* – A collaboration tool that allows for instant messaging, file sharing and other customizable plug-ins.

*Telerehabilitation*- the delivery of rehabilitation services over telecommunication networks and the internet.

*Unity* - a cross-platform game engine developed by Unity Technologies and used to develop video games for PC, consoles, mobile devices and websites.

*USB 3.0* - The third major version of the Universal Serial Bus (USB) standard for interfacing computers and electronic devices. Among other improvements, USB 3.0 adds the new transfer rate referred to as *SuperSpeed USB (SS)* that can transfer data at up to 5 Gbit/s (625 MB/s), which is about ten times as fast as the USB 2.0 standard.

*Visual Gesture Builder* - Visual Gesture Builder (VGB) generates data that applications use to perform gesture detection at run time. By using a data-driven model, VGB shifts the emphasis from writing code to building gesture detection that is testable, repeatable, configurable, and database-driven.