MSc project computer science structure:

**Introduction:** Make sure have included the importance of this project within my introduction

* How this is relevant to force rehabilitation exercises
* Does not need to be done in presence of a clinician
* Can take analyse multiple forms of data, e.g hand tracking, force tracking, client progress (better than current forms of progress tracking)

**Literature review:**

* Explanation of what research has already been performed in a specific area
* Analysis and critical evaluation of that literature
* Highlight gaps and how will my research contribute to this

Each paper make notes on: e.g do this as a table

* Research question
* Methodology
* Results
* Conclusion
* Strengths, weaknesses or gaps in research

When critiquing papers

* Date research was conducted
* Impact and reach of the research
* Breadth and depth of research
* Overgeneralisations and assumptions
* Methodological limitations & strength
* Recommendations and calls for further research

Structure:

* Wheel approach
  + This structure might be useful if there are various approaches to understanding your topic
  + Your subject is the ‘centre’ of the wheel
  + You might discuss different theories, approaches or methodologies that apply to this topic, but are themselves dissimilar and separate

Paragraph structure: look at the example lecture slides for example paragraph

* Introduce your point
* Elaborate your point with sources
* Comment on the evidence
* Conclude your point

Find literature on

* Haptic devices and their relevance on rehabilitation
* VR and its relevance on rehabilitation
  + Game design for rehabilitation
* Look at the plan below and find references for each bullet point

**Designing the software to create communication between the force dimension delta and Unity**

How to create comport

How to compile sdk in C

How to run a script in unity to call the software I create

1. Learn how to program using the force dimension SDK
2. Modify the examples so forces can be sent from unity
3. How to get a com port and get it into unity and
4. Transmission protocol
5. Com port in unity and in the haptic device (SDK example)
6. Writing the program for software to make the client server talk to each other
7. Need communication between them

Next:

* Are the forces applied through unity or the haptic device, applied gradually, through unity will give me stability, SDK can manage it
* Simple unity scene where I just need to press button to give a force response
* Evaluation does the program work, is the simulation good enough, did I reach the target, document my targets and did I reach them, could also use users and get feedback

Unity TCP connection scripts and try build from one of these to establish communication

C+ and c# program to establish a TCP connection

Write a client script for the TCP server script and implement this in unity

**Book notes:**

Stroke base rehabilitaton: haptic technologies p.g 26

**Literature review plan:**

* What are the challenges in upper limb rehabilitation
* What current techniques are there in upper limb rehabilitation
  + With or without use of robotics
  + Using robotics and/or virtual reality
* What current techniques are there to measure progress of patient’s rehabilitation program and why using a force dimension haptic device will allow better understanding of progression

Main reason for using haptics devices

* Idea 1: The use of force feedback to improve the efficacy of patient recovery
  + Assistive forces, good and bad, and do they work?
  + Resistive forces, good and bad, and do they work?
* Idea 2: Data that the force feedback device can provide
  + Providing more insight into a patients progress with more force data provided
  + The adaptability of VR and haptic device to match the patients progress, so programs can be individualised as sensory motor damage is different in everyone
  + Gamify to give loads of feedback during and after the rehabilitation exercises
  + This product as a result of all the data that it can provide can be an indication of relapsing of unsuccessful surgery
  + Objective assessment vs subjective assessment (clinician vs robotic)
  + Effective haptic tests can analyse a patients kinaesthetic or tactile sense
* Idea 3: Motivation of patients when they are discharged from hospital
  + Paper showing improved motivation using game based rehabilitation
  + (Piggott, Wagner and Ziat, 2016)
* Idea 4: Current upper limb rehabilitation techniques using VR and Haptic feedback and how these are better than conventional therapy and feedback
* Idea 5: what current robotics are used for upper limb rehabilitation
  + **Conventional rehabilitation techniques and assessment**
    - Include a paragraph about how sensory motor control is assessed in neurorehabilitation research, and how my project will benefit the assessment (Piggott, Wagner and Ziat, 2016)
    - Include what my device will be able to measure and how is this better for understanding and assessing patient treatment therapy and upper limb rehabilitation
    - Include kinaesthetic measurement and proprioceptive data feedback from haptic devices

**Methodology notes:**

Interface design: (chapter 11)

* Interface provides data to the actuation unit and catches and transmits all the data from the sensors (517)
* Speed of transmission is most relevant bottleneck when designing haptic devices (517)
* Most haptic controllers integrated into simulator as and external hardware component (521)
  + Reduces computer load for main simulator and reduces data rate significantly
* Table 11.1 – required unidirectional data rates for typical haptic devices
* At a frequency of 1 to 10 Hz: this specifies the rate at which the force output (e.g gravitational force) should be updated by the simulator (e.g VR) i.e the simulator should provide force outputs that are updated between 1 and 10 times per second (11.2.3 - 520)

Code:

* Use the fixed update method to update the forces within unity project

The camera or user visual placement is determined by the haptic device and unity integration

* In some camera placements the perspective meant that the x, y, and z axis’s were mixed up, which also impacted the forces, especially the repelling force

**Making my game**

Making the ball move in curve fashion

* Getting the sin of many points

Creating attractive force exercise: 31/08/2023

* Use coordinates of the target object and end effector to apply forces to the haptic device in the direction of the target object
* Turn forces off when the object enters a specified area close to the ball
* Apply resistive forces when the user has successfully been inside the ball for longer than 5 seconds
  + Need to check the times on this and make sure they are a measurable outcome
  + Could also remove these forces if needed
* Applying the resistive force:
  + Apply a resistive force if the user has been inside the object for longer than 5 seconds
  + OR apply a resistive force every 15 seconds, apply the force for 5 seconds
  + Always apply the resistive force for longer than
* Create a repelling force rather than adding a force to a different random point
  + As you get closer to the ball, the repelling force is harder
  + As you get further away from the ball, the repelling force gets smaller

Creating a repelling force exercise: 7/08/2023

* Create a force between the sin points that repel the haptic device away from the target object
  + This could be done by spawning circles between the 2 randomly generated points along the sin line that repel the haptic device
  + How can I vary the realism of the ball movement:
    - Vary the frequency
    - Vary the amplitude
    - Vary the phase: make the sine wave move

Make the ball change colour when its inside the target

Making the scene, just create a room

* Priority is to make sure the user won’t feel disorientated

o