PARKinetics

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Table of Contents

Revision History 3
Introduction 4
Intended Audience List 4
Features/Functional Requirements 5
Home Page 5
Profile Page 6
Free Play Page 7
Finger Twister 8
Shadow DDR 9
Adventure Story 10
Settings Page 11
Non-Functional Requirements 12
Product Requirements 12
Usability Requirements 12
Efficiency Requirements 12
Dependability Requirements 12
Security Requirements 12
Organizational Requirements 13
Environmental Requirements 13
Operational Requirements 13
Development Requirements 13
External Requirements 13
Regulatory Requirements 13
Ethical Requirements 13
Legislative Requirements 13
Example Tutorials 14
Glossary 18
References 19

Table of Figures

Table 1: Detailed record of the revision history for this document ····· 3
Figure 1: Sample View of Home Page ····· 5
Figure 2: Sample View of Profile Page ····· 6
Figure 3: Sample View of "Finger Twister" ····· 8
Figure 4: Sample View of "Shadow DDR" ····· 9
Figure 5: Sample View of "Adventure Story" ····· 10
Figure 6: Home Page Screen ····· 14
Figure 7: Profile Page Screen ····· 14
Figure 8: "Finger Twister" game screen ····· 15
Figure 9: "Adventure Story" game screen ····· 16
Figure 10: "Shadow DDR" game screen ····· 17

Revision History

Table 1: Detailed record of the revision history for this document

Revision	Status	Publication/Revision Date	Author
1.0	First Draft	October 02, 2019	Rachel Djauhari
1.1	Added/Formatted Non-Functional Requirements	October 12, 2019	Rachel Djauhari
1.2	Added Functional Requirements	October 13, 2019	Rachel Djauhari
1.3	Added Game Features	October 15, 2019	Rachel Djauhari
2.0	Described Game Features, Added Pictures, and Formatted Glossary	October 15, 2019	Rachel Djauhari
2.1	Added more features	October 16, 2019	Rachel Djauhari

Introduction

Our iOS app “PARKinetics” aims to bring “Big changes with small movements”. We gamify existing therapeutic exercises that target at least 1 of 5 of the major symptoms of Parkinson’s Disease (PD): balance, facial rigidity, speech, digit dexterity, and posture **[1]**. The results and improvements from gameplay will be recorded in a radial chart that the users can view. By utilizing our app, PD patients will have a better understanding of PD and learn to work with it and to use the games and exercises to slow the regression of facial, fine-motor, and rhythmic abilities.

Intended Audience List

Our app will be geared towards elderly patients (60+ years) because Parkinson’s is known to appear more often in the elderly compared to children **[1]**. It will be more beneficial to those who exhibit symptoms of progressed, but not terminal, PD diagnosis. They should have basic self-living abilities, have some experience handling iOS devices (i.e. iPad), and are willing to try video games as a form of therapy. The goal and expectation from using our app is not a complete recovery, but a decrease in the regression of their symptoms. “PARKinetics” will also provide caretakers of Parkinson’s patients with the means to have an entertaining yet useful extension to treatments and give the patients the opportunity to exercise their motor and speech skills outside of long treatment sessions in a relaxed and safe environment.

Features/Functional Requirements

Home Page

- [ ] "PARKinetics" shall have a home page to be able to navigate to different subpages such as Profile, Free Play, and Settings
- [ ] The app shall have an information button summarizing the intended use of "PARKinetics"

Figure 1: Sample View of Home Page

Profile Page

- The profile page shall have a radial chart that displays the progress of the patients from analyzing their recent gameplays.
- Users shall be able to access their data and improvement over time from their profile page.
- In the full, marketable implementation of this app, users shall have login credentials that will allow them to access their profile and their data.
- The profile page shall have a button to allow users to easily return back to the home page.
- The profile page shall have a button that enables the user to view their previous progress report.

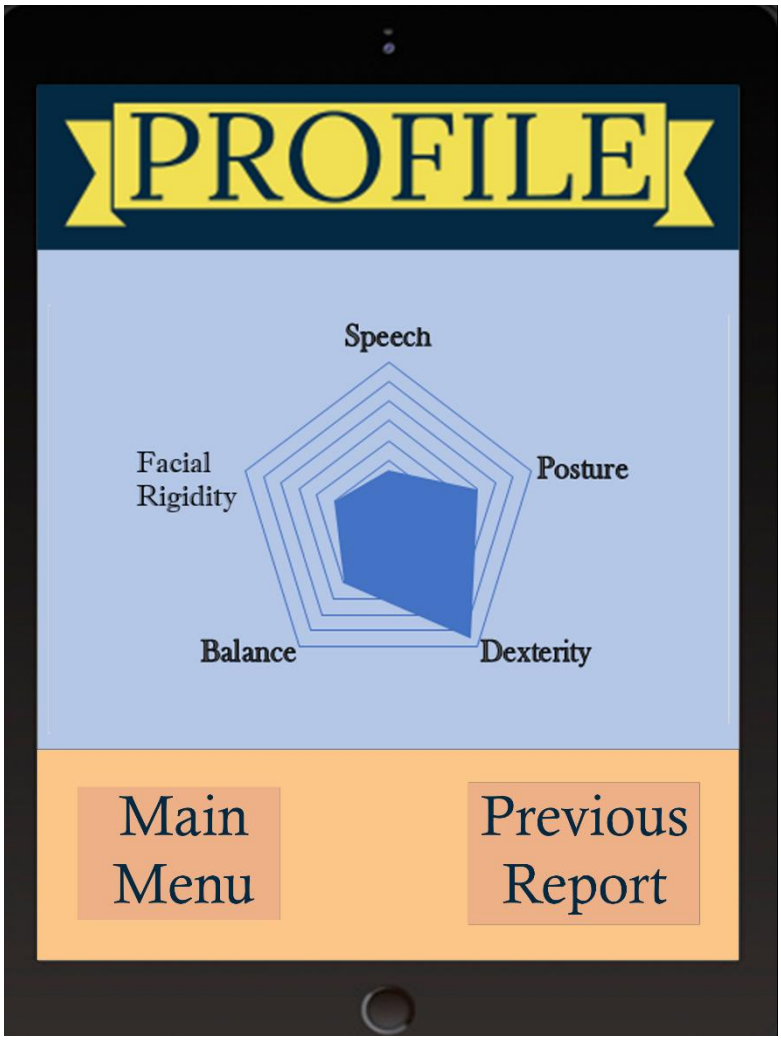

Figure 2: Sample View of Profile Page

Free Play Page

- [ ] The app shall have a Free Play page to display the available games such as: Adventure Story, Shadow DDR, and Finger Twister.
- [ ] This subpage shall have a navigator to return back to the home page.
- [ ] The Free Play page shall have games that are in the 5 categories of the most common symptom's for Parkinson's balance, facial rigidity, speech, digit dexterity, and posture.
- [ ] There shall be a feature on this page that allows users to view the game achievements they have earned.

Finger Twister

- The game shall incorporate music that provides a beat they can play along to.
- There shall be a base line score that will be set from their first try of the game to compare and give them future scores.
- There shall be difficuly levels created by changing the speed, and the number of squares to tap (more squares means smaller boxes).

Figure 3: Sample View of "Finger Twister"

Shadow DDR

- [ ] This game shall make use of the front-facing camera and augmented reality to present movements for the user to follow and identify the degree of correctness/acc uracy of the user's movements compared to the outline on the screen.
- [ ] The game shall increase in difficulty by increasing the complexity of the movements and the speed at which to complete them.
- [ ] The scores shall be calculated by taking into account how fast the user completes the movements and how accurately.

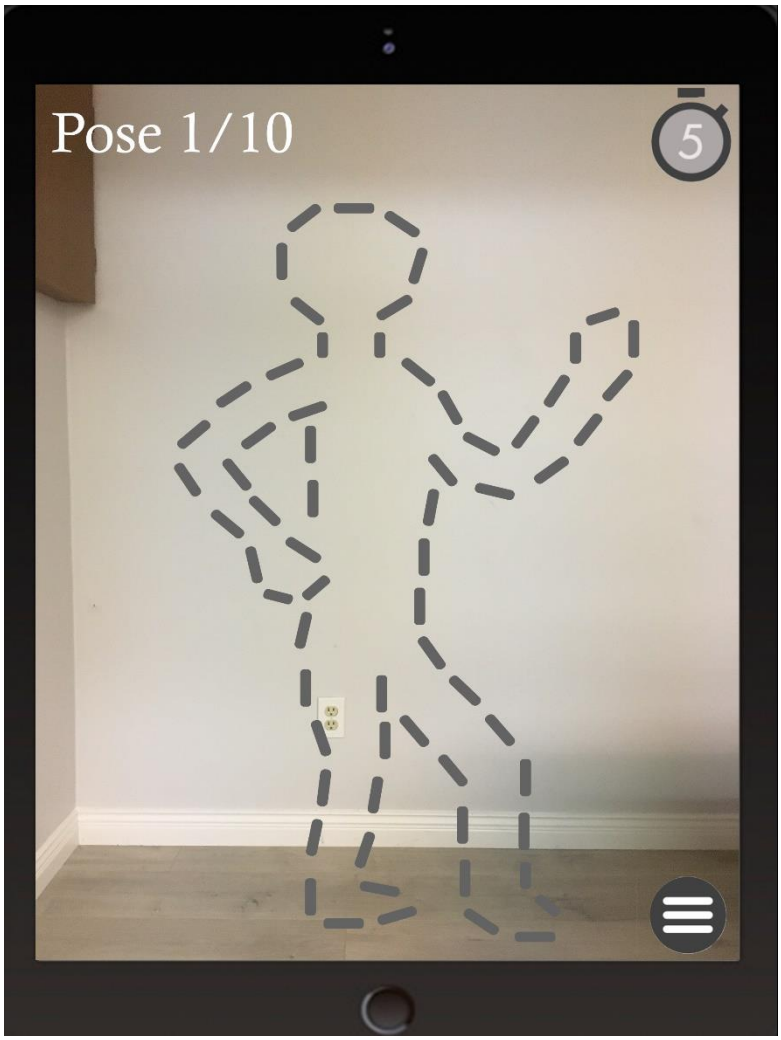

Figure 4: Sample View of "Shadow DDR"

Adventure Story

- [ ] This game shall employ speech therapy by encouraging the users to choose between a few different options by speaking them into the mic of the device in order to move on with the storyline.

- [ ] This game shall have a few different storylines to choose from and have a saving capability in which the user can continue where they left off in the story or restart it.

- [ ] The score for this game shall be calculated based on the accuracy of the user's spoken words in comparison to what is written on screen as well as the time it takes to say the phrase taking into account how long the phrase is.

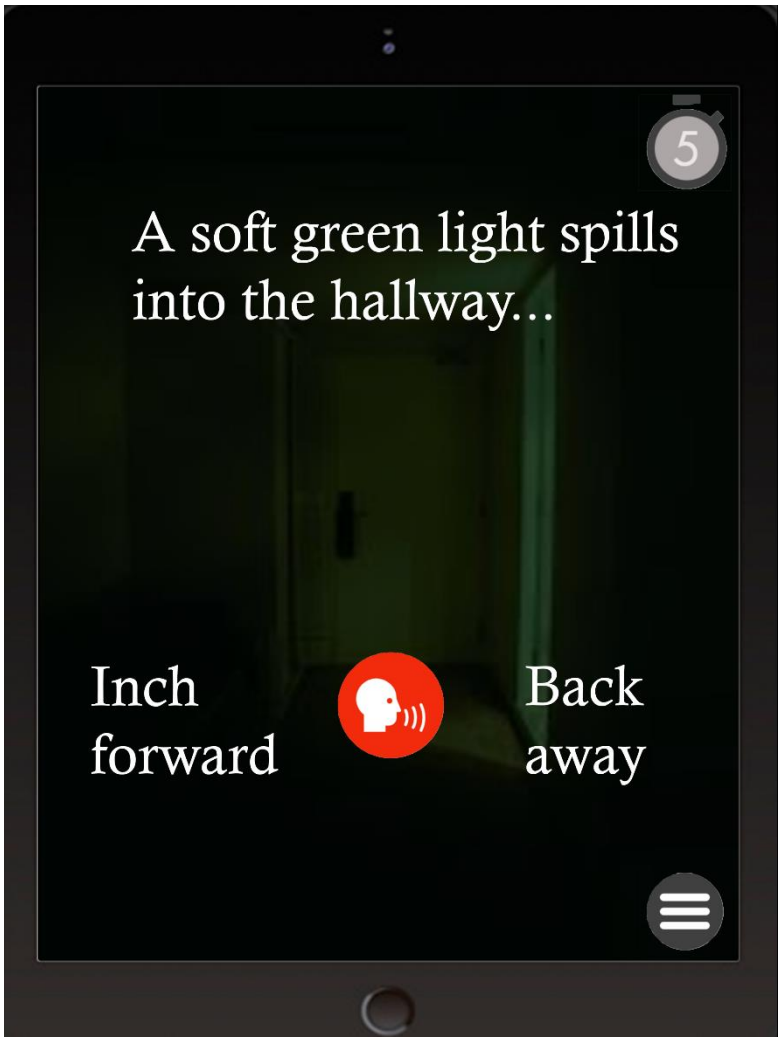

Figure 5: Sample View of "Adventure Story"

Settings Page

- [ ] "PARKinetics" shall have a settings page to allow the users to modify the app and game settings.
- [ ] The settings page shall have the option to change the length of each game.
- [ ] The settings page shall have a language setting which is, by default, in English.

Non-Functional Requirements

Product Requirements

Usability Requirements

- [ ] The complexity of the structure of the application, "PARKinetics", must be low and users must be able to find what they are looking for in the app within to nested subpages.
- [ ] The organization of the interface must have less than 5 buttons for easy navigation and include access to the user's profile, and games.
- [ ] The circular buttons of the main page must be large enough for the user's to press with ease (diameter must occupy 80% - 90% of the screen width).
- [ ] The font size must be large for easy readability regardless of the set font size on the device (14 point font size).
- [ ] The "PARKinetics" application must be usable without having to physically hold on the device (specifically the iPad) meaning that all games should be playable while keeping the device on a flat surface such as a tabletop.

Efficiency Requirements

- [ ] Launching of the app must happen within 2 seconds.
- [ ] Loading time of each game must be within 5 seconds of clicking on the desired game.
- [ ] Back-end connection and reading/writing data to the database must complete within 2 seconds.
- [ ] The entire app must occupy a maximum of 10MB of device storage.

Dependability Requirements

- [ ] The "PARKinetics" app must not crash at all on any occassion when used by the users.
- [ ] Any text input needed in the app must have error handling for incorrect text inputs and indicate to the user to re-enter with the correct input.
- [ ] The backend server must be up a running 24/7 with 99% user availability.
- [ ] The application must not have any memory leaks to prevent from occupying excessive memory.

Security Requirements

- [ ] Before keeping record of user data, the user must agree and authorize to have their data being stored and used for the purposes of tracking the user's improvement.
- [ ] Users of "PARKinetics" must only have access to their own data and no one else's.

Organizational Requirements

Environmental Requirements

- [ ] Usage of the app must be in a brightly lit room (1500-2500 lumens) especially when the camera is being used.

Operational Requirements

- [ ] The application's software code must be committed to github which will enforce version control.
- [ ] "PARKinetics" will be designed for iOS Version 10 and above.

Development Requirements

- [ ] The application must be programmed in Swift/Objective-C.
- [ ] "PARKinetics" will be developed on Xcode Version 10.3 (10G8).
- [ ] The app's backend services will be developed using Firebase services.

External Requirements

Regulatory Requirements

- [ ] There must be regular checks for leakages of user data (at least once a week).

Ethical Requirements

- [x] There must not be any information given to any third party organization(s) at any time without the user's consent.
- [ ] There must not be any unique identifiers that would reveal the identity of the user or breach the privacy of their data/personal information.

Legislative Requirements

- [ ] Users of "PARKinetics" must be provided with the terms and conditions of the software regarding their personal information when first starting to use the app and at every software update of the app.

Example Tutorials

Home Screen:

The app will open to this screen, allowing the user to access all games, their profile, and app settings through the large rectangles. More information about the app can also be accessed by tapping on the information sign in the bottom right corner such as the purpose of the app, development team, and other details.

Figure 6: Home Page Screen

Profile:

The profile screen is where users can monitor their game-to-game progress. Their latest calculated scores for the Parkinson's symptoms that are being evaluated are displayed in a radial chart. The radial chart provides a visual representation of a user's current abilities. Previous radial charts can also be accessed from the "Previous Report" button. The user may choose to return to the main menu after evaluating their progress by tapping on the "Main Menu" button.

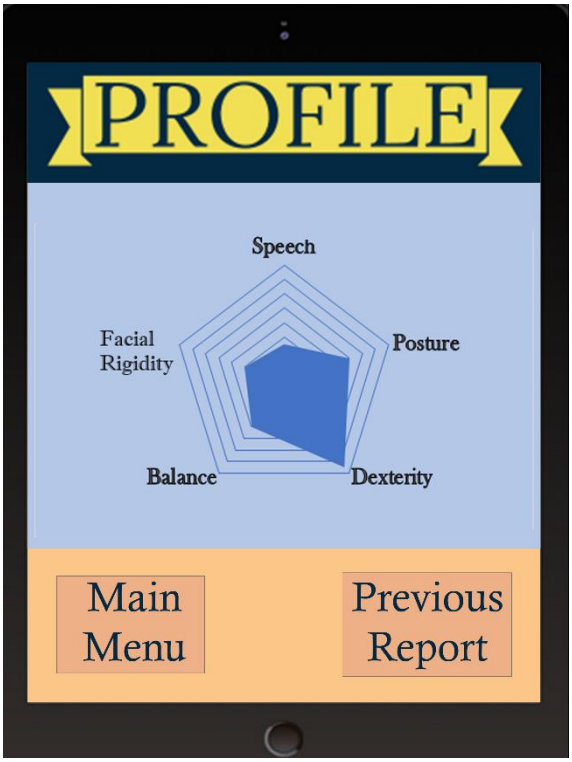

Figure 7: Profile Page Screen

Finger Twister:

"Finger Twister" is a game intended to allow users to utilize fine motor skills and work on finger rigidity and dexterity. The generic game screen can be seen in Figure 8. The game will display text to the screen indicating game start. When tiles on the square grid light up in a different colour than grey, the user will have a set amount of time to tap on the indicated tiles simultaneously. When time is close to expiring for the indicated tiles, the indicated tiles will change colour again. This process of tapping tiles is repeated for the duration of the timer indicated in the top right corner of the "Finger Twister" screen, which counts down from 60 seconds from game start. Taps on indicated tiles are synchronized to a beat or tune, hence the mixing table theme of the graphical interface. This results in a simulation that the user is creating or mixing music. Upon game end, the results of the game will be displayed; a percentage of tiles successful hit will be the main metric for calculating the dexterity score. The screen will then transition to the Profile screen, with the radial chart updating based upon the results.

Figure 8: "Finger Twister" game screen

“Adventure Story”:

The story game allows users to explore a branching narrative using speech to make path decisions. The typical gameplay screen can be seen in Figure 9. The story text will be displayed near the top of the screen, with the path choices displayed in text on either side of a speech icon. Users will speak aloud the words of their path choice, and if the speech resembles the words to an acceptable level, the story progresses down the chosen path. The timer in the top right corner of Figure 9 indicates the amount of time left to successfully match their speech with the path text. If the timer expires before a successful match, a path will automatically be chosen to progress the story. The story will be broken down into chapters, and each game session will cover one chapter. At the conclusion of a chapter, the results of the game will be displayed; a percentage of words successfully matched will be the main metric for calculating the speech score. The screen will then transition to the Profile screen, with the radial chart updating based upon the results.

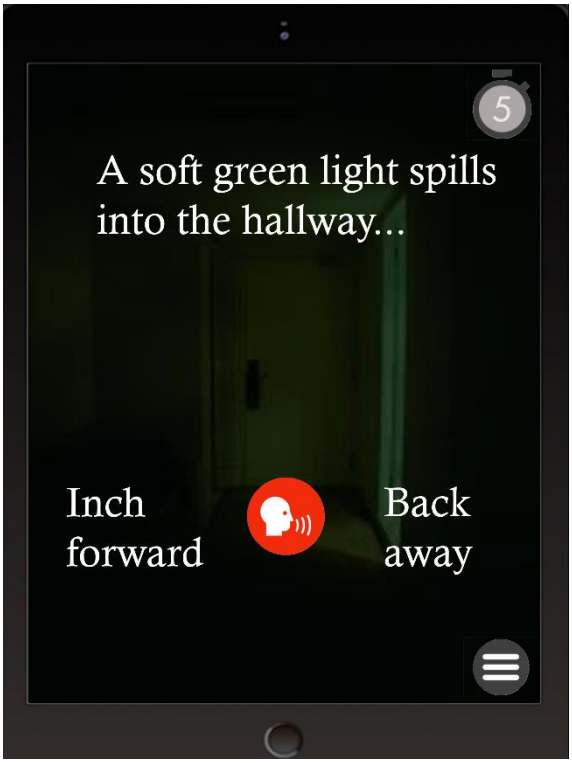

Figure 9: "Adventure Story" game screen

“Shadow DDR”:

In this game the user must orient their device such that the front facing camera displays a full view of their body on the screen. At game start, a pose will be displayed on the screen by means of a dashed outline in real time along with the camera view, as seen in Figure 10. Additionally, at game start, the game will measure the user’s default posture by taking the angle deviation of their torso from a line perpendicular to the floor. Users must attempt to fit their bodies inside the pose by matching limb and torso position to the pose figure. The timer in the top right corner of Figure 10 indicates the amount of time the user must orient themselves currently. At timer expiry, the game will calculate what percentage of the user’s body lies inside the outline. A new pose will then be displayed, and the timer reset. Upon completion of 10 poses, the results of the game will be displayed; a percentage of the user’s body inside the outline for each pose will be the main metric for calculating the balance score. The posture score will also be displayed by taking the average deviation of posture from the default posture position and will constitute the posture score. The screen will then transition to the Profile screen, with the radial chart updating based upon the results.

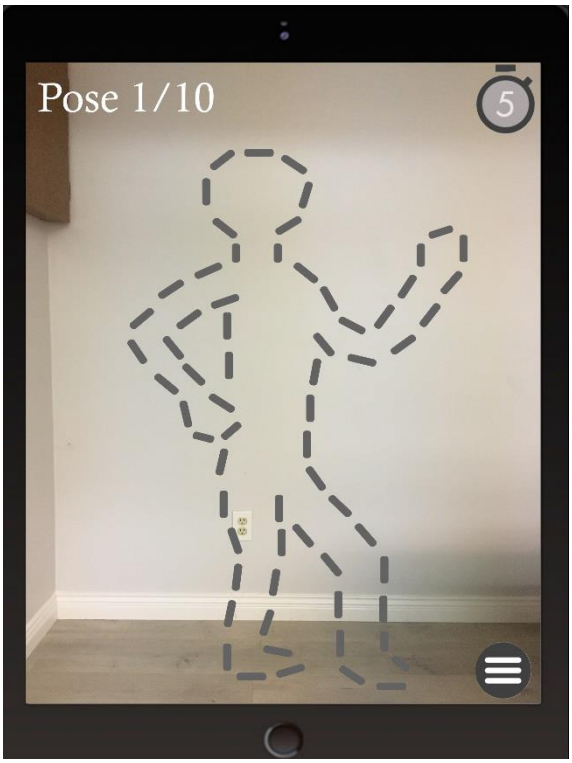

Figure 10: "Shadow DDR" game screen

Glossary

1. Gamify
    a. Apply typical elements of game playing (e.g. point scoring, competition with others, rules of play) to (an activity), typically as an online marketing technique to encourage engagement with a product or service **[2]**.
    b. To make an activity more like a game in order to make it more interesting or enjoyable **[3]**.

2. Therapeutic
    a. Having a healing effect; tending to make a person healthier **[3]**.

3. Therapy
    a. Treatment that helps someone feel better, grow stronger, etc. **[3]**
    b. Treatment to help a person get better from the effects of a disease or injury **[3]**.

4. Rigidity
    a. The quality of being stiff, fixed, or impossible to bend **[3]**.

5. (Digit) dexterity
    a. The ability to perform a difficult action quickly and skilfully with the hands **[3]**.

6. Posture
    a. A position of the body, or the way in which someone holds the body when standing, sitting, or walking **[3]**.

7. Radial Chart
    a. A **radar chart** is a graphical method of displaying multivariate data in the form of a two-dimensional chart of three or more quantitative variables represented on axes starting from the same point.

8. Regression
    a. The fact of an illness or its symptoms (= effects) becoming less severe.

9. Fine motor
    a. The coordination of small muscles, in movements—usually involving the synchronisation of hands and fingers—with the eyes. Involves movements that occur in the wrists, hands, fingers, feet, and toes e.g. picking up objects between the thumb and finger and writing carefully, and even blinking.

10. Exercise
    a. An action or actions intended to improve something or make something happen **[3]**.

11. Balance
    a. To be in a position where you will stand without falling to either side **[3]**.

12. Speech
    a. The ability to talk, the activity of talking, or a piece of spoken language **[3]**.

13. Facial
    a. Of or on the face **[3]**.

14. Rhythmic
    a. Responding and moving the body in time with a beat, tempo, or pitch of music.

15. Symptoms
    a. Any feeling of illness or physical or mental change that is caused by a particular disease **[3]**.

16. Terminal
    a. Cannot be adequately treated and is reasonable expected to result in the death of the patient.

17. Self-living abilities
    a. The ability for an individual to perform daily functions and obtain a satisfactory quality of life (Maja Lampa).

18. Caretaker
    a. An individual responsible for supervising and maintaining the well-being of another.

19. Motor
    a. Relating to muscles that produce movement, or the nerves and parts of the brain that control these muscles.

References

[1] Mayo Clinic, "Parkinson's Disease," Mayo Foundation for Medical Education and Research, 30 June 2018. [Online]. Available: https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/symptoms-causes/syc-20376055. [Accessed 24 September 2019].

[2] Oxford University, "Oxford Learner's Dictionary," Oxford University Press, 1 February 1884. [Online]. Available: https://www.oxfordlearnersdictionaries.com/us/. [Accessed 15 October 2019].

[3] Cambridge University, "Cambridge Dictionary," Cambridge University Press, 1995. [Online]. Available: https://dictionary.cambridge.org/. [Accessed 15 October 2019].