



PARKinetics

Group Name: TANKER

Group Number 6

<https://ksackvil.github.io/CMPT-275/>

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Revision History

Table 1. Detailed record of revision history of this proposal document

Revision	Status	Publication/Revision Date	Author
1.0	Creation	September 23, 2019	Armaan Bandali
2.0	Re-compilation	September 24, 2019	Armaan Bandali
2.1	Modification of Summary	September 24, 2019	Takunda Mwinjilo
2.2	Modification of Overview	September 25, 2019	Takuna Mwinjilo
3.0	Formatting, Edits	September 25, 2019	Rachel Djauhari
3.1	Formatting, Meeting data added	September 25, 2019	Kai Sackville-Hii

Project Summary

Our iOS app “PARKinetics” aims to bring “Big changes with small movements”. We will emulate known stretches and self-administered treatments via minigames that target 1 or more of 5 major symptoms (5 categories) of Parkinson’s disease (PD): balance, facial rigidity, speech, digit dexterity, and posture. We hope to make learning to manage PD from home fun and engaging. The games not only educate the patient but also help track the slow the regression of facial, fine-motor and rhythmic abilities to give them a better understanding of their own abilities.

Although PARKinetics is aimed at elderly patients (50+ years) exhibiting symptoms of a progressed, but not terminal, PD diagnosis, it is well suited to individuals of all ages who are looking at alternative forms of therapy.

By learning from the successes and failures of other serious games and platforms for PD such as WuppiD[3] and rhythm builders[1], as well as incorporating the wealth of knowledge available on managing PD, we aim to create an entertaining yet useful extension to treatments that give patients the opportunity to exercise motor and speech skills outside of long treatment sessions in a relaxed and safe environment. By “gamifying” existing hand, wrist, speech and rhythm exercises we hope to make these activities more entertaining and accomplishing to fulfill.

Project Overview

Parkinson’s disease (PD) is one of the most common neurodegenerative disorders. It primarily affects the senior population. The main physical symptoms of PD are the slowness or loss of movement, the rigidity of the arms, legs or trunk, resting tremor, and impaired posture and balance [6]. It cannot be cured. Though medicine and surgery are the primary treatments, lifestyle changes such as frequent, daily exercise are also used to manage PD [2],[6].

Several studies demonstrate the efficacy of game therapy with motivating patients to manage their condition outside of therapy [1]-[5]. Many patients find physical therapy sessions long and boring and the use of video games can make the home based management of the physical symptoms of

PD more engaging and fulfilling [2][5]. PARKinetics is built for PD patients (primarily late onset but also early onset patients) who frequently use their mobile devices. By incorporating both fine motor stretches, speech training and posture exercise directly into daily gameplay, we hope to provide exciting alternatives that users can enjoy from the comfort of their homes. The games will not only entertain, but also educate patients on the exercises and motions they are doing.

While physical movement is obviously an integral part of game therapy for PD, the excitement and positivity elicited from games are crucial to successful therapy. The motor symptoms of PD are often exacerbated by anxiety and embarrassment of loss of function. Games are a way for PD patients to achieve small successes and escape reality, building upon their self-confidence and believe that they can still trust their abilities and live healthy lives

Feature List

Feature 1: Free Play (Collection of games)

Game 1: Finger Twister

“Finger Twister” will be one of our games intended to target PD patients’ fine motor skills and digit dexterity. Owing its name to the popular contortion game “Twister”, the game will similarly feature a grid of dots on the device’s screen. The player will attempt to position their fingers on a number of dots that light up among the grid. The pattern of lit up dots will appear rhythmically in such a way as to challenge the player to contort their fingers through a wide range of fine movements. The score or progress is measured by percentage of dots successfully touched over ten different patterns.

Game 2: Shadow Fit

“Shadow Fit” will be a game that utilizes the device’s camera and aims to improve PD patients’ posture and balance. Players will position themselves in front of the camera then the game will ask the player to stand up as straight as possible. This will provide a baseline for the player’s posture. A silhouette or body outline will appear on the screen, mimicking an existing yoga or tai-chi poses. The goal for the player is to match the pose outlined by the silhouette and maintain their balance. The game will cycle through several poses and the progress is measured by the average percentage of their body falling inside of each silhouette.

Game 3: Adventure Story

“Adventure Story” is a game that uses speech commands to direct a player’s character to make decisions throughout a text-based adventure. The game aims to challenge PD patients to exercise their facial muscles and practice speech. Players will progress through the game by successfully directing their character through a story based maze via short succinct commands. By helping create their own stories the game will teach PD patients know speech therapies such as the Lee Silverman Techniques as well as teach them to convert longer, lengthier sentences to shorter ones to aid them in daily communication.

Feature 2: Profile, Progress Tracking, and Difficulty

Each of the statistics collected in the games will be recorded in a database. This data can then be viewed visually via radial graphs and progress will be tracked over time. Game difficulty will be decided by these statistics in order to maintain daily engagement in the games.

PARKinetics hopes to improve upon the successes and failures of previous trials of using video games for PD patients such as WuppiD[2], Microsoft Kinect[4] and Leap Motion[3]. These trials found improvements in fine-motor skills as well as rhythmic abilities for patients who used the applications consistently, which is promising and warrants further research on the topic. It can also aid those with motor neuron diseases other than Parkinson's, as well as by those seeking to maintain their fine motor-skills, rhythmic abilities and speech.

Project Planning

We will be using Github as our configuration control software, our subversion repository is located at <https://github.com/ksackvil/CMPT-275>. Progress of the project will be reported via the following methods:

1. "Trello" will be used as a team collaboration tool and review the deadlines for certain milestones and deliverables
2. "Slack" is used as the main communication for the team.
3. "Canvas" is used as the main form of communication with the Professor

Meeting are scheduled for Tuesdays and Thursdays at 10:30 AM in the SFU Applied Science Building. If meetings are required outside of the set times, or are necessary before an important deadline, Skype will be used to allow for remote meetings.

The budget for software and game developers is calculated based on the amount of time they put into this project. If each employee gets paid \$30/ hour for 6 developers, it would cost around \$75,600 for 3 months. We are using the web service Firebase for data storage, which is free up until the storage limit. Therefore, no cost would be added to the budget of this project.

Project Schedule

KEY TASKS	START DATE (mm/dd/yy)	END DATE (mm/dd/yy)	MILESTONES/DELIVERABLES
HW 1	9/13/2019	9/25/2019	Project Plan
			Proposal Document
			Team Website
HW 2	9/25/2019	10/16/2019	Requirements Document
			Initial Design
SWIFT PROJECT SET UP	9/26/2019	10/3/2019	App Design and Structure
DATABASE	10/3/2019	11/4/2019	Firestore Setup
			Data Structure
			Connect App with Firestore
PROFILE SCREEN	10/10/2019	11/4/2019	Profile Screen UI
			Radial Chart
			Gameplay History
HOME SCREEN	10/3/2019	11/4/2019	Home Screen UI
			Game Loader
GAME - "SHADOW DDR"	10/10/2019	11/17/2019	Shadow Matching/Movement Matching
			Image Analysis via Camera
			Levels of Varying Difficulties
			Point System/Way to Measure Progress
			Game Design
			How to Play/Rules
GAME - ADVENTURE STORY	10/17/2019	11/17/2019	Speech Analysis via Microphone
			Have Different Stories Available
			Levels of Varying Difficulties
			Point System/Way to Measure Progress
			Game Design
GAME - FINGER TWISTER	10/3/2019	11/4/2019	How to Play/Rules
			Levels of Varying Difficulties
			Point System/Way to Measure Progress
			Game Design

Figure 1. Estimate of Project Schedule

Risk Management

Table 2. Explanation of the severity of risk levels as colours for project development

Risk Level	Description
	The result of a risk of this level occurring will hamper objectives in the impact area to reduce the quality of work, but still be implementable.

	The result of a risk of this level occurring will lead to some objectives in the target area to not be implemented, or to be implemented poorly.
	The result of a risk of this level occurring will have serious repercussions on the impact area and will almost certainly lead to the failure of several key objectives.

Table 3. Possible risks, severity, and their reduction associated with project development

RISKS	LIKELIHOOD	IMPACT AREA	MITIGATION STRATEGY
Estimation			
The time required to develop the app is underestimated.	Possible	Project and product	<ul style="list-style-type: none"> • More weekly development time • Main functions of the app will be prioritized
Organization			
Task distribution is not reasonable.	Possible	Project	<ul style="list-style-type: none"> • Teammates communicate and reflect work progress in weekly meeting • Work distribution can be adjusted to be more reasonable after discussion and analysis
People			
Team members do not have required skills.	Possible	Project	<ul style="list-style-type: none"> • Experienced members can provide instruction and resources to help less experienced members
Team members are ill and unavailable at critical time.	Possible	Project	<ul style="list-style-type: none"> • Members have overlapping or closely related tasks so they can easily pick up unfinished tasks
Requirements			
The project needs to be redesigned when requirement changes.	Possible	Project and product	<ul style="list-style-type: none"> • Communicate with stakeholders frequently and try to minimize changes
Project plan must be overhauled if concept is rejected	Possible	Project	<ul style="list-style-type: none"> • Several back up plans will be prepared
Technology			

Hardware on Apple devices do not have enough precision as expected.	Possible	Project	<ul style="list-style-type: none"> May not be feasible to have customized hardware Rough test on precision should be done before full implementation of the game
Reusable software has defects and can not work as expected.	Possible	Project	<ul style="list-style-type: none"> Choosing a famous open source project will lower the possibility of having defeats in modules
Tools			
Different version of Xcode cause incompatible code integration.	Possible	Project	<ul style="list-style-type: none"> Agreement on the version of Xcode should be done before start of development
iOS/SWIFT upgrade leads to substantial rework of project.	Likely	Project	<ul style="list-style-type: none"> Smoke test will be done after iOS upgrade
Hardware			
iOS device is not available.	Rare	Project	<ul style="list-style-type: none"> We have at least two iOS devices for testing so far
Mac machine is not available.	Unlikely	Project	<ul style="list-style-type: none"> We have two personal Mac machines for front-end developers. Mac machines in lab should be enough for developers

Project Organization



Yuxiang Huang

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Back End Development

My name is Yuxiang Huang and I am a third-year computer engineering student. I mainly use C/C++ for school assignments/projects and Javascript for personal projects. I have work experience for Express.js server and Testng(Java test framework). My interest are full stack web development and real time system.



Rachel Djauhari

rdjauhar@sfu.ca

Project Manger

Game Development

My name is Rachel Djauhari (rdjauhar@sfu.ca) and I am a third year Engineering Science Student that majors in Computer Engineering. My main programming language(s) are C and C++, but am familiar with C#, XAML, basic python and html. Experience I have in trying to create an app is from when I participated in LumoHacks 2018 in which we were tasked to create something to help those with PTSD.



Kai Sackville-Hii

ksackvil@sfu.ca

Front End Development

My name is Kai Sackville-Hii and I am a 3rd-year Computer engineering student. I have experience in full stack web development from my co-op at SAP Canada Inc. My job (Research and Development) was to innovate solutions to improve SAP's internal code review process. Along with another coworker, I designed and implemented WASP an internal tool for managing and cataloging web services used in SAP products. I learned many new skills from my time at SAP, which I use today in my personal endeavor Apptize Virtual Menu. Appetize is a platform currently in development which connects food industry vendors with their customers, digitalizing the restaurant experience.



Takunda Mwinjilo

tmwinjil@sfu.ca

Front End Development

My name is Takunda Mwinjilo and I am a 3rd-year Computer engineering student. I have been using C/C++ for 4 years in both classes as well as my co-op at Keytechs Systems and innovative solutions. I also have short term experience with Swift, Java and Python, as well as iOS application development. As one of the front-end engineers I hope to make the parkinetics UI intuitive to navigate as well as pleasing to the eye.

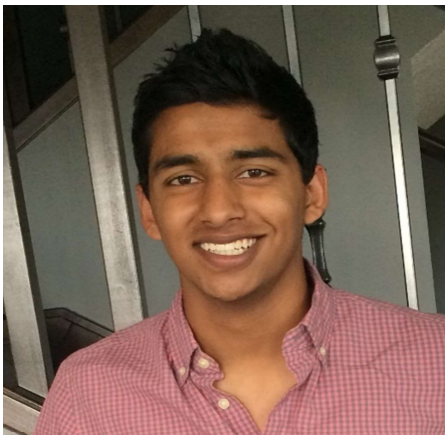


Negar Hariri

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Front End Development

My Name is Negar and I'm a 4th-year Computer Engineering Student. I have experience in automation using Python and C in my coop at Sierra Wireless as a software Test Engineer. I have experience in C/C++, Python, and SQL. My main interest is database design. Also, I'm interested in to explore areas in the mobile application and game design.



Armaan Bandali

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Game Development

Armaan Bandali is a third-year computer engineering student at Simon Fraser University. Drawing from his various jobs in customer service, tutoring, and his recent co-op position as a Technology Coordinator for Science All!ve, Armaan has acquired valuable experience in report writing, test scripting, and team leadership. Armaan is proficient in C and C++ while also possessing knowledge of other languages and programs. His aspirations are to further his coding skills and get involved in the game development industry.

References

- [1] Dauvergne, C., Bégel, V., Gény, C., Puyjarinet, F., Laffont, I., & Dalla Bella, S. (2018). Home-based training of rhythmic skills with a serious game in Parkinson's disease: Usability and acceptability. *Annals of Physical and Rehabilitation Medicine*, 61(6), 380-385.
- [2] Foletto, A., Cordeiro D'Ornellas, M., & Cervi Prado, A. (2017). Serious Games for Parkinson's Disease Fine Motor Skills Rehabilitation Using Natural Interfaces. *Studies in Health Technology and Informatics*, 245, 74-78.
- [3] Assad, Oliver & Hermann, Robert & Lilla, Damian & Mellies, Björn & Meyer, Ronald & Shevach, Liron & Siegel, Sandra & Springer, Melanie & Tiemkeo, Saranat & Voges, Jens & Wieferrich, Jan & Herrlich, Marc & Krause, Markus & Malaka, Rainer. (2011). Motion-Based Games for Parkinson's Disease Patients. *Proceedings of the tenth International Conference of Entertainment Computing: Lecture Notes in Computer Science*, 6972. 6972. 47-58. 10.1007/978-3-642-24500-8_6.
- [4] Galna, B., Jackson, D., Schofield, G., Mcnane, R., Webster, M., Barry, G., . . . Rochester, L. (2014). Retraining function in people with Parkinson's disease using the Microsoft kinect: Game design and pilot testing. *Journal of Neuroengineering and Rehabilitation*, 11(1), 60.
- [5] Dowling, G., Hone, R., Brown, C., Mastick, J., & Melnick, M. (2013). Feasibility of adapting a classroom balance training program to a video game platform for people with Parkinson's disease. *Telemedicine Journal and E-health : The Official Journal of the American Telemedicine Association*, 19(4), 298-304.
- [6] 'Parkinson's disease', 2018. [Online]. Available: <https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/symptoms-causes/syc-20376055> [Accessed: Sep. 25, 2019].

Appendix A

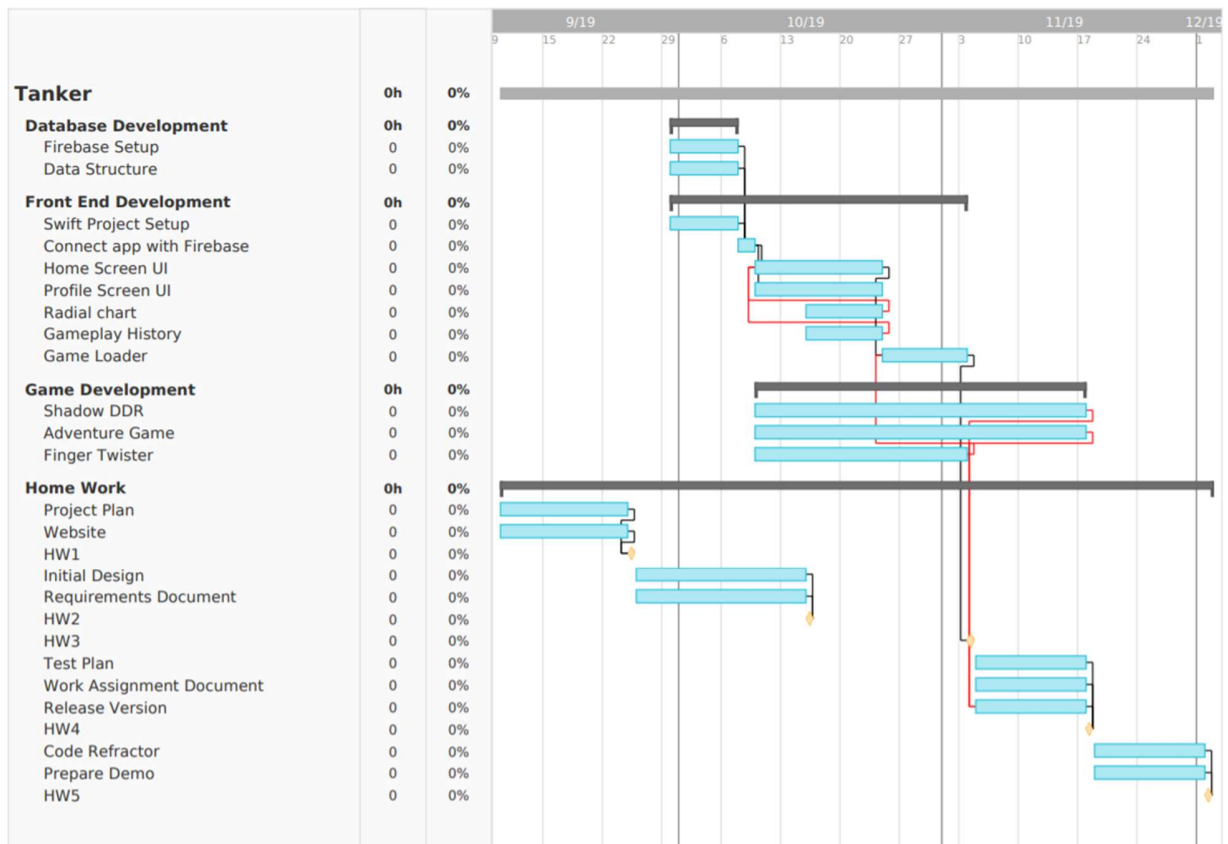


Figure 2. GANTT Chart for project planning

Appendix B

19 September 2019
10:30 am
ASB
CMPT 275
Group 6

1. A brief summary of what we discussed last meeting as well as what we achieved prior this meeting
2. Discuss PM role — who should take it
3. Paper prototype
 - a. Starting up app
 - b. Main page
 - i. Categories to choose from
 1. dexterity/mobility
 2. Speech
 3. balance/posture
 4. Facial expressions
 5. ...
 - ii. account(?)
 - iii. levels(?)
 - c. After choosing a category
 - i. Games
 - d. After choosing a game...
4. Tentative timeline for project
5. Possible risks and how to mitigate them

Figure 3. Agenda for Meeting 3

24 September 2019
10:30 am
ASB
CMPT 275
Group 6

✓	TO BE DISCUSSED (ITEMS)
✓	Name for app
✓	Update on website
✓	Update on proposal document <ul style="list-style-type: none">• Table of contents• Revision history• Project summary• Project overview• Project planning• Project schedule• Risk management• Project organization and staff plan<ul style="list-style-type: none">◦ Team roles/responsibilities• References (IEEE)
✓	Features: list the key features only (within our scope and time constraint)
	Work breakdown structure
	milestones/phases/deliverables (GANTT Chart) — MS Project CSIL

Figure 4. Agenda for Meeting 4

16 September 2019
4:30pm
CMPT 275
Group 6

- Introducing ourselves
- Team name: **TANKER**
- Discussing what we know (so far) about parkinsons
- Reviewed the deliverables of the assignment
 - Discussed who is our audience and possibilities of what the app can be for
 - Discussed the platforms to use for database (Firebase), website(Github), version control (Github), etc.
 - Came up with 2 ideas (send reports and to therapists and doctors that help them come up with a special compilation of exercises for the patient):
 - Interactive games that help decrease the effect of parkinsons on the body and mind
 - Movement and activities that use AR and can track the motion of the patient ← the more difficult one
- FOR NEXT MEETING:
 - Learn more about parkinsons and its symptoms
 - Create a short biography and have a picture ready for website
 - Discuss ideas and come up with one → start proposal
 - Have a solid weekly, in-person meeting date and time

EXTRA INFO ABOUT PARKINSONS:

https://parkinsonslife.eu/top-apps-for-the-parkinsons-community/?fbclid=IwAR0Kk4qFEJ6ybb_EuXJbyMeemC9u3bGH2ubozwvmQPmVWMLEkosYOTjC9m7I
https://parkinsonslife.eu/top-apps-for-the-parkinsons-community/?fbclid=IwAR0Kk4qFEJ6ybb_EuXJbyMeemC9u3bGH2ubozwvmQPmVWMLEkosYOTjC9m7I

PLATFORMS/WEBSITES ETC:

<https://opencv.org/?fbclid=IwAR0IsVvY9vBu98s2uZLpIPs9bZhTKExyuaHmSmc38XsUYwQA5dVy5n-zfyI>
<https://firebase.google.com/?fbclid=IwAR1rFWeLP5GyhnHKLz7sBJPuLf-yvtN2gD387hwZchpNwQQxvtukTbviFZk>

Figure 5. Minutes for Meeting 1

17 September 2019
10:30 am
ASB
CMPT 275
Group 6

- Brief summary of what was covered last time
- Identified elderly people as the audience
 - Video games can help parkinsons patients
 - Mobility
 - Lots of research that backs that up
 - Focus on therapy
- Parkinsons cant be totally cured
 - Only slowed down
 - Reduce stress
 - Listen to music
 - Whether depression or anxiety increases risk of parkinsons
- Github website is up (github pages)
- Discussion of which to use: decided on swift
- A lot of apps already track brain and monitor progress
- AR pet to do exercises with you
 - Taking care of a pet
 - Can take care of it in ways that are physically challenging
 - Helps with planning and scheduling
 - (tamagatchi?)
- Technical specifications
 - Swift
 - Data input
 - Sensors?
 - User input
 - Video feed
 - Database
 - Firebase (network component)
 - Unity for creating the games
- Idea → game therapy (AR and phone)
 - Implement levels
 - Categories:
 - Dexterity/Mobility
 - Line following
 - Speech
 - balance/posture
 - Match the figure/position
 - Facial expressions
 - Match silly faces
 - Keeping track of progress
 - Assign scores (progress report)

Figure 6. Minutes for Meeting 2, page 1

- If they don't do well we will push them down a level
 - Points relative to level
- Initial test to figure out level
- About 30mins max (10-15 mins a day average)
 - A fixed daily goal rather than them setting a reminder for themselves
 - Sharing game progress with others
- Camera stabilization
 - Part of something bigger?
- Other ideas that target mental health aspect of parkinsons
 - Babylon telus
 - Chatbot
 - Feature to communicate with loved ones (side feature)
- Combining ideas?
- Communication
 - Change from messenger to slack
- Next meeting:
 - Specifics of game stuff
 - Paper prototype of app
 - 3 solid game ideas from each person by next meeting
 - Bio and picture and info for website
 - Spreadsheet for available times

Figure 7. Minutes for Meeting 2, page 2