**SONOMA STATE UNIVERSITY**

**Title here….**

Project

By

**Name HERE….**

****

Department of Engineering

Submitted in partial fulfillment of the requirements

For the degree of

Masters of Science in Computer Science & Engineering

Supervisor: Dr. xxxx

**Date**

Accepted by the Graduate School

\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date, Dean of the Graduate School

The undersigned have examined the project entitled ‘xxxxx’ presented by **your name** a candidate for the degree of **Master of Computer Science & Engineering** and hereby certify that it

is worthy of acceptance.

Date Advisors name

Date committee member name

Date committee member name

# DECLARATION OF AUTHORSHIP

I, YOUR NAME declare that this project titled, **title of the work** and the work presented in it is my own. I confirm that:

* This work was done wholly or mainly while in candidature for Master’s degree at

Sonoma State University.

* Where any part of this project has previously been submitted for a degree or any

other qualification at this University or any other institution, this has been clearly

stated.

* Where I have consulted the published work of others, this is always clearly attributed.
* Where I have quoted from the work of others, the source is always given. With

the exception of such quotations, this project is entirely my own work.

* I have acknowledged all main sources of help.
* Where the project is based on work done by myself jointly with others, I have made

clear exactly what was done by others and what I have contributed myself.

\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dated Signed

*“ whatever” –* who ever...

# ABSTRACT

Parkinson’s disease tremors.

# ACKNOWLEDGMENTS

I would like to thank thin.

# 

# CONTENTS

DECLARATION OF AUTHORSHIP (iii)

ABSTRACT (v)

ACKNOWLEDGMENTS (vi)

LIST OF FIGURES (viii)

LIST OF TABLES (ix)

**CHAPTER 1: INTRODUCTION 1**

1.1 OVERVIEW 1

1.2 WHAT IS PD 2

1.3 CAUSES 3

1.4 SYMPTOMS 3

1.5 TREMOR 4

1.6 AIM OF THE STUDY 5

**CHAPTER 2: LITERATURE OVERVIEW AND SYSTEM DESIGN 6**

2.1 INTRODUCTION 6

2.2 PREVIOUS WORK 6

2.3 PROBLEM STATEMENT 7

2.4 SYSTEM DESIGN 8

2.5 PROCEDURE OVERVIEW 8

**CHAPTER 3: DATA ANALYSIS 11**

3.1 INTRODUCTION 11

3.2 CALCULATING ACCELERATION 13

3.3 CALCULATING ANGULAR VELOCITY 14

3.4 FREQUENCY DETECTION 15

3.5 AMPLITUDE DETECTION 16

3.6 HARDWARE SELECTION 20

3.7 ACCELEROMETER 20

3.8 GYROSCOPE 23

3.9 DEGREES OF FREEDOM 24

**CHAPTER 4: RESULTS & DISCUSSIONS 25**

4.1 OVERVIEW 25

4.2 TESTING METHODOLOGY 25

4.3 METHODOLOGY FOR SELECTING APPROPRIATE AXIS 26

4.4 RESULTS FOR SELECTED AXIS 27

4.5 SCALE FACTOR 28

4.6 ACHIEVEMENTS 29

**CHAPTER 5: CONCLUSION & FUTURE WORK 30**

5.1 CONCLUSION 30

5.2 FUTURE WORK 31

**REFERENCES**

**APPENDICIES**

# 

# 

# LIST OF FIGURES

**CHAPTER 2: LITERATURE OVERVIEW 6**

**Figure 2.6:** Overview of the system 10

**CHAPTER 3: DESIGN & SYSTEM MODEL 11**

**Figure 3.1:**  Screen Shot of the GUI 12

**Figure 3.2:** Data from Accelerometer 13

**Figure 3.3:** Data from Gyroscope 14

**Figure 3.4a:** Frequency calculation in each axis using FFT 15

**Figure 3.4b:** Frequency determined along Y-axis of gyroscope 16

**Figure 3.5a:** Acceleration versus Time 18

**Figure 3.5b:** Velocity versus Time 19

**Figure 3.5c:** Displacement versus Time 20

**Figure 3.7a:** Accelerometer mass on a spring model 21

**Figure 3.7b:** Mechanism illustration of MEMS accelerometer 22

**Figure 3.8:** Mechanical Gyroscope 23

**Figure 3.9:** Six degrees of freedom: forward/back, up/down, left/right, pitch, yaw, roll 24

# 

# LIST OF TABLES

**CHAPTER 4 25**

**Table 4.3**: Appropriate axis for measuring frequency and amplitude 27

**Table 4.4:**  Axis showing maximum values of frequency and amplitude 27

**Table 4.5:**  Software Parameters 28

# CHAPTER 1

## INTRODUCTION

### 1.1 OVERVIEW

Neurological

device.

# 

# 

# REFERENCES

1. Hague, S., Klaffke, S., & Bandmann, O. (2005). Neurodegenerative disorders: Parkinson’s disease and Huntington’s disease. J Neurol Neurosurg Psychiatry, 76(8), 1058-1063.

2. Parkinson's Disease Foundation. Retrieved from http://www.pdf.org

3. Stephenson, J. (2000). Exposure to home pesticides linked to Parkinson disease. JAMA, 283, 3055-3056.

4. National Parkinson’s Foundation. Retrieved from http://www.parkinson.org/

5. Niazmand, N., Klaffke, T., & Kalaras, A., Dept. Micro Technol & Med. Device Technol., Tech. Univ. Munchen Garching,Germany (2011). A measurement device for motion analysis of patients with Parkinson’s disease using sensor based smart clothes. IEEE, 9-16.

6. [Blumrosen, G.](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Blumrosen,%20G..QT.&searchWithin=p_Author_Ids:37283107300&newsearch=true) ; Sch. of Eng. & Comput. Sci., Hebrew Univ. of Jerusalem, Jerusalem, Israel ; [Uziel, M.](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Uziel,%20M..QT.&searchWithin=p_Author_Ids:37541437600&newsearch=true) ; [Rubinsky, B.](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Rubinsky,%20B..QT.&searchWithin=p_Author_Ids:37294502400&newsearch=true) ; [Porrat, D.](http://ieeexplore.ieee.org/search/searchresult.jsp?searchWithin=p_Authors:.QT.Porrat,%20D..QT.&searchWithin=p_Author_Ids:37282055400&newsearch=true)(2010). Tremor acquisition system based on UWB Wireless Sensor Network. IEEE,187-193.

7. Delano.; Brian, P., [Georgia Tech Research Institute (2012)](file:///C:\Users\Hussainis\Desktop\Georgia%20Tech%20Research%20Institute%20(2012)). Retrieved from http://www.gtri.gstech.edu/

8. Kabai, S. (2007). Gyroscope. Retrieved May 14, 2015, from http://demonstrations.wolfram.com/Gyroscope/

9. American Academy of Family Physicians. (2013). Retrieved from http://www.aafp.org

10. Charles, V, Loan.,Cornell University, Ithaca, New York. Computational Frameworks for the Fast Fourier Transform. (1992). SIAM.

11. S, Butterworth. Theory of Filter Amplifiers. (1930). Retrieved from http://www.electronics-tutorials.com/

12. Smeja, M.; Foerster, F.; Fuchs, G.; Emmans, D.; Hornig, A.; Fahrenberg, J.

Journal of Psychophysiology, Vol 13(4), 1999, 245-256

13. Noel L.W. Keijsers ,;  Martin W.I.M. Horstink ; San C.A.M. Gielen PhD. (2005) Movement disorders , [Vol 21(1),](http://onlinelibrary.wiley.com/doi/10.1002/mds.v21:1/issuetoc)34–44

# APPENDICIES

### 