CS415, Human Computer Interaction:

Exercise #5 – HCI

DUE: As Indicated on Canvas and Syllabus

Please thoroughly read Chapters 20 in Dix-Finlay-Abowd-Beale’s HCI book.

Please read papers on historical, current or proposed HCIs as noted in the exercises below.

Exercise #5 Requirements:

1) [10 points] Research, identify and briefly describe the 3 worst software engineering design flaws and/or software defects of all time [try using https://scholar.google.com/ and look at candidates including: Apple Newton, Three Mile Island, Mars Observer, Ariane 5-501, Cluster spacecraft, Mars Climate Orbiter, ATT 4ESS Upgrade, Therac-25, Toyota ABS Software, Blackberry Storm, Windows Genuine Advantage, Windows 8, Windows ME, Apple Lisa, Pentium FPU bug, or system failures such NORAD false alarms, Mars Express Beagle 2, and the Challenger and Columbia Shuttle Loss]. State why the 3 you have selected are the worst in terms of negative impact, negligence, and bad decisions made from a software engineering viewpoint. Rank them from worst to least worst.

2) [10 points] Research, identify and briefly describe the 3 worst HCI designs (and/or implementations) of all time based on your research from #1. State why the HCI in each scenario could be considered root cause for a significant failure, loss of life or property, or discontinuation of the related product and why the operators should not and could not be blamed for the failure. Rank them from worst to least worst.

3) [30 points] The Therac-25 is a radiation therapy machine that over-dosed and is implicated in the deaths of more than one patient where root cause is suggested to have been faulty system design including software and the operator interface. Read the papers found on Canvas by Dr. Nancy Leveson and others who have investigated the system and attempted to find root cause as well as software/systems engineering and HCI lessons learned. [Papers you can consult include: a) Medical Devices: The Therac-25, Appendix in SAFEWARE: SYSTEM SAFETY AND COMPUTERS, Nancy G. Leveson, ISBN: 0-201-11972-2, b) An Investigation of the Therac-25 Accidents, Nancy G. Leveson and Clark S. Turner, IEEE Computer, 1993, c) Jacky, Jonathan. "Programmed for Disaster." The Sciences 29 (1989): 22-27, d) An Engineering Disaster: Therac-25, Joanne Lim, October 1998.]
   a) [5 pts] Provide a summary of key findings by Dr. Leveson.
   b) [5 pts] Can you find any papers written by other authors that disagree with the key findings of Dr. Leveson? If so, what are the alternate key findings?
c) [5 pts] Based on your understanding, describe what you believe to be the root cause of the fatal and near fatal accidents involving this machine and whether the root cause at all involves the operator interface.

d) [15 pts] From the perspective of good HCI design and implementation, note at least 3 well-known HCI standards, guidelines, or principles as found in our HCI book, that were violated in the Therac-25 operator interface design and implementation.

4) [50 points] Form a team of 2, 3, or 4 students and propose a final HCI prototype, experiment, or design exercise to do as a team. You must mock-up or prototype an HCI for an application for which you can also design a usability experiment as we studied (covered in Chapter 9 of our text). You can for example design and prototype a C/C++, Java, Python, C#, or other 2D GUI, 1D CLI or more advanced interactive systems using cameras or 3D rendering that improves upon an existing application or provides a totally new application. Pick an application you find interesting with key HCI features that promise improvement over common interaction models so you can design a detailed usability experiment as described in Chapter 9 of our textbook – you must make sure that you follow ERAU IRB guidelines for tests with human subjects and/or that you have approval for your proposed testing from the IRB. You can test with users within our class or within your group to simply “test the test” to make sure your usability experiment will work. Testing outside of the class with IRB approval is not required, but would make the experience more interesting.

a) [30 pts] You or your proposed Group should submit a proposal that outlines your exercise in HCI improvement, design and/or evaluation with all group members clearly identified. This should include some research with citations (at least 3) or papers read, key methods to be used (from book references), and what you read and consulted to decide upon your final group exercise.

b) [20 pts] Each individual should turn in a paragraph on their role in the project and an outline of what they intend to contribute.

Overall, provide a well-documented professional report of your findings, output, and tests so that it is easy for a colleague (or instructor) to understand what you’ve done. Include any C/C++ source code you write (or modify) and Makefiles needed to build your code. I will look at your report first, so it must be well written and clearly address each problem providing clear and concise responses to receive credit. Note that it is up to you to pick an OOP for implementation and tools of your choice to develop and test your application – this is a large part of the challenge of this assignment.
Grading Rubric

[10 points] 3 worst software failures:

[3 points] #1 ____________________________________________

[3 points] #2 ____________________________________________

[3 points] #3 ____________________________________________

[1 point] ranking_________________________________________

[10 points] 3 worst HCI failures:

[3 points] #1 ____________________________________________

[3 points] #2 ____________________________________________

[3 points] #3 ____________________________________________

[1 point] ranking_________________________________________

[30 points] Therac-25 investigation:

a) [5 pts] Key findings by Dr. Leveson__________________________

b) [5 pts] Alternate key findings_______________________________

c) [5 pts] Root cause and culpability of HCI_______________________

d) [15 pts] 3 well-known HCI standards, guidelines, or principles that were violated in the Therac-25 operator interface:

i) ______________________________________________________

ii) _____________________________________________________

iii) _____________________________________________________

[50 points] Final exercise proposal:

[30 points] Group proposal ________________________________________________

[20 points] Personal contribution____________________________________________