Score Sheet. 600.445 Homework #5 – Fall 2003
Name:_____________________; Email: ______________

| 1. Identification & discussion of factors | 50 |
| 2. Mathematical analysis & bottom-line estimate | 40 |
| 3. Discussion | 20 |
| **Total** | **110** |

I worked alone on this assignment and followed all other guidelines:

______________________________
signature                      date
General Notes and Instructions

1. I would really appreciate typed, double spaced and READABLE output that is firmly attached together. Sketches can of course be hand drawn. I am not looking for beauty, just legibility and room to mark them up. Generous margins are also nice.

2. Put your **name** and **email address** on each sheet and number the sheets

3. Attach the grade sheet as the first sheet and attach all sheets together.

4. You must include a self-addressed, seal-able 8 ½ x 11 inch envelope if you expect to the homework to be returned (per JHU’s interpretation of FERPA).

5. You should work **alone** on this exercise.

6. The problem is open book, notes, library, etc. But you should cite any source materials you use or consult.

7. I do **not** expect truly expert answers at this point, nor am I expecting a great deal of clinical expertise beyond that included in the referenced book chapters. The main purpose of this exercise is to get you thinking analytically about the relationship between systems, application needs, and technology.

8. This assignment is due at the start of class on 10/3/03. I urge you to start earlier
Assignment 5: Identification of factors

- This is a continuation of Assignment 4. Essentially, I want you to perform an accuracy analysis of the system you have designed in Assignment 4.
- Identify the factors affecting accuracy of your system. These might include such things as
  - Patient motion & breathing
  - The accuracy with which you can measure optical marker positions
  - Motion of the optical tracking system and/or robot base
  - The design & dimensions of any custom instruments needed
  - The accuracy with which a robot’s end-effector can be positioned relative to its base
  - Etc.
- Explain each factor qualitatively (sentence or two at most). What is it and why/how is it likely to affect system accuracy.
- Provide plausible estimates for the magnitude each factor. (e.g., a typical optical tracker will track markers to about 0.3mm accuracy over a 1 meter cubed field, when the markers are about 2 meters from the sensor base. You can assume that a typical XYZ stage used in medical robots can position its end-effector to accuracies in the range 0.01-0.05 mm, depending on design and that a typical rotational stage might be accurate to about 0.02 degrees)
Assignment 5: Analysis

• Give formulas showing analytically the sensitivity of each of the overall sensitivity of your system to the factors that you have identified.

• Combine these formulas with your assumptions to give a “back of the envelope” estimate for the accuracy of your system.
Assignment 5: Discussion

• Discuss the implications of your analysis.
• For example, if there are any obvious modifications to the system design that would improve the overall accuracy, identify them and discuss briefly.
• Similarly, are there any obvious places where cost might be reduced or overall ease-of-use improved if an accuracy factor design specification is relaxed a bit?