Assignment 1 – User Needs Analysis (70 points)

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| **Due date:** | See CANVAS for submission deadline and instructions. |
| **Objective:** | The goal of this assignment is to define the project scope, understand the needs of potential users, and gain deeper knowledge of the design problem through discussions with technical experts. |

1. Project Scope (/5 points)
2. **Problem Statement**. Describe the goal of this project in your own words (2-3 sentences, not copied from the project description) (/2 points)

The University of Utah’s Mechanical Engineering Department will soon be implementing a new automation course where students will learn how to use Programmable Logic Controllers. This course will offer a lab where students will be able to interact with a fully automated robotic process line controlled by PLCs. This process line will initially be too complex to teach students about the basics of PLCs. Our group is tasked with creating a PLC Trainer platform, capable of teaching students the basics of PLC control. This PLC Trainer should implement various sensors and actuators that are outlined in the scope, can interact with the robot purchased for the lab, have modular input/output configurations to allow students to experiment with multiple field devices and have sufficient documentation to support its feasibility.

1. **Scope.** Complete the following table detailing the required project scope, optional additional scope, and elements outside the project scope. Rank items in the “optional additional scope” column in order of priority (1 = highest priority additional scope item) (/2 points).

|  |  |  |
| --- | --- | --- |
| Must be part of scope | Optional next steps (rank) | Not included in Scope |
|  |  |  |

1. List all possible users of your design. Be sure to include both “mainstream” and “extreme” users, as discussed in class (/1 points).

|  |  |
| --- | --- |
| Mainstream Users | Extreme Users |
| * Students * Teaching Assistants * Professors * Lab Staff | * Elderly students, TA’s, Professors, Lab Staff * Students, TA’s, Professors, and Lab Staff with disabilities (Needs to be Easily Accessible and Configurable) * Foreign Exchange/Non-English-Speaking Students, TA’s, Professors, and Lab Staff |

1. User Interviews (/20 points)

Conduct interviews of **two** potential users of your design. Due to the importance of gathering outside input in the early stages of design, project team members and team faculty advisors do not qualify as users for this assignment. Complete the following table for each user interview. Provide detailed notes from your interview in the Appendix to this assignment, *including a list of questions/materials prepared by design team in advanced of interview* (part E).

1. User #1 (/10 points)

|  |  |
| --- | --- |
| Interviewee: | Mikael |
| Interviewer(s): | All members of senior design team |
| Interview location/time/duration (/1 point for rows 1-3): |  |
| Explain why the interviewee is a good candidate for understanding user needs (3-5 sentences)(/1 point): | Mikael has experience working with PLC’s on his senior design project. This was his first introduction to PLC’s so he is very familiar with learning about PLC’s for the first time. Aside from his experience with PLC’s, his interest in robotics and automation will play a major role in identifying what students with an interest in PLC’s will want from a PLC trainer. |
| What technique(s) that we learned in class did you use in conducting this interview? See Chapter 3, Table 1 for documentation to include with your technique(s) (/1 point) |  |
| Summarize your key findings from the interview (3-5 bullet points) (/3 points): |  |

Additional points:

* List of questions/materials prepared by design team in advanced of interview (include in Appendix) (/2 points)
* Detailed interview notes provided in Appendix (/2 points)

1. User #2 (/10 points)

|  |  |
| --- | --- |
| Interviewee: | Jensen Coumbs |
| Interviewer(s): | All members of senior design team |
| Interview location/time/duration (/1 point for rows 1-3): |  |
| Explain why the interviewee is a good candidate for understanding user needs (3-5 sentences) (/1 point): | Jensen is an undergraduate student with no experience in PLC’s but with an interest in learning about them. He is interested in robotics and controls, which are tools that can be controlled by PLC’s. Jensen is a good candidate to know what students with no experience with PLC’s would like when it comes to a training platform for PLC’s. By interviewing Jensen, our team can identify what students with no experience in PLC’s know and don’t know about how they work. |
| What technique(s) that we learned in class did you use in conducting this interview? See Chapter 3, Table 1 for documentation to include with your technique(s) (/1 point) |  |
| Summarize your key findings from the interview (3-5 bullet points) (/3 points): |  |

Additional points:

* List of questions/materials prepared by design team in advanced of interview (include in Appendix) (/2 points)
* Detailed interview notes provided in Appendix (/2 points)

1. Technical Expert Interviews (/10 points)

Conduct an interview of **one** technical expert that can provide insight into your design challenge. Technical experts may have knowledge related to engineering challenges specific to your design, or particular applications of your design. Your faculty advisor may NOT be your technical expert, but can help you identify a relevant technical expert. You are encouraged to find a technical expert that is NOT a faculty member in the mechanical engineering department. Complete the following table for your interview. Provide detailed notes from your interview in the Appendix to this assignment, *including a list of questions/materials prepared by design team in advanced of interview* (part E).

1. Technical Expert (/10 points)

|  |  |
| --- | --- |
| Interviewee: | Patrick Russo |
| Interviewer(s): |  |
| Interview location/time/duration (/1 point for rows 1-3): |  |
| Explain why the interviewee is considered a technical expert for your project (3-5 sentences) (/1 point): | Patrick Russo is an engineer for NovaTech Automation which specializes in electrical substation automation and control systems. NovaTech utilizes PLCs as a controller in their work. Patrick makes hiring decisions for the company based on candidate PLC experience and knowledge. He will be a good candidate to interview due to his grasp on industry standards concerning PLCs. |
| What technique(s) that we learned in class did you use in conducting this interview? See Chapter 3, Table 1 for documentation to include with your technique(s) (/1 point) |  |
| Summarize your key findings from the interview (3-5 bullet points) (/3 points): |  |

Additional points:

* List of questions/materials prepared by design team in advanced of interview (include in Appendix) (/2 points)
* Detailed interview notes provided in Appendix (/2 points)

1. User Needs Testing (/20 points)

The goal of user needs testing is to place yourself in the “shoes” of your prospective users, and see the design problem from their perspective. User needs testing activities are also known as “empathy-oriented prototypes”, because they help you to experience the design problem first-hand.

Examples of user needs testing include but are not limited to:

- Physical tests that help you understand design constraints (e.g. size, weight, etc.);

- Spending time with users and documenting their experiences (e.g. photo-journal);

- Extensive background research on the design environment (if you can’t directly go “into the field”);

- Simulating the user environment and challenges;

- Experimenting with existing design solutions or related devices and documenting their advantages/limitations;

One “large” user needs tests or several “small” tests are acceptable, as long as multiple insights into user needs can be gained (see question 3).

1. Describe the goal of your user needs testing in one paragraph (e.g. what are you trying to learn?) What user group(s) are you seeking to understand? (/4 points):
2. Describe what you did for your user needs testing exercise in one paragraph (e.g. activities/tasks performed, prototyping conditions/set-up, etc.) (/4 points).
3. Summarize the key findings from your user needs testing experience (6-10 bullet points) (/6 points):
4. Include detailed notes/photos/videos from your testing experience in the Appendix of this assignment (or upload as supplementary files on Canvas) (/6 points)
5. Prioritized List of User Needs (/15 points)
6. Create a bulleted list of user needs. This list should come from your interview notes and notes from your user needs testing. (/12 points)
7. Add rankings to the each need in the list created in part 1. Add the rankings to the list. Describe the ranking system you are using (i.e. what does 1, 2, 3, etc. mean?). (/3 points)

1. Appendix (points included under part D, User Needs Testing)

Include the following supplementary material in the Appendix to Assignment 1:

1. Notes from user interviews. Include questions/other materials prepared by design team for interview.
2. Notes from technical expert interviews.
3. Notes, photos, and/or videos documenting your user needs prototype.

Appendix

Questions for Mika

1. In your opinion, what are the essentials a student must learn to begin using PLCs?
2. Is there a specific model of PLC you think students should learn on?
3. What field devices would be most valuable for a student to use?
4. If you were taking this course, what would you hope to get out of it?
5. How sturdy do we need to make this trainer?
6. What are some of the more difficult things to understand about PLCs?
7. What should be easily accessible on this trainer?
8. What information would be useful to display on the HMI?
9. What is the skill level needed to properly utilize a PLC?
10. What is the most important thing to remember when using a PLC?

Questions for Jensen Coumbs

1. What interests you about PLCs and what would you like to learn about them?
2. What do you already know about PLCs?
3. How do you envision yourself using a PLC system in the future?
4. What field devices would be most interesting to control using a PLC system?
5. What is the most intimidating thing about PLCs?

Questions for Patrick Russo

1. What are some common challenges those learning about PLC’s face?
2. What are the most important aspects of PLC’s that new graduates should be familiar with?
3. What initial challenges do you see in this project?
4. What features do you think would be most useful to students?
5. What interface configuration would most closely simulate what is used in the industry?