Pre-Lab 2: Assignment Submission Document

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Lab section: <mark>CB5</mark>

Read the definitions, then _address questions 1-10 in this manual, export as a PDF, and submit on Gradescope_. **This is an individual assignment.**

Some Important Definitions

- **User/Stakeholder Requirements -** documentation of what must be provided to users/stakeholders to satisfy their needs.
- **System Requirements -** documentation of the constraints and capabilities of a system able to satisfy the user/stakeholder requirements.
- **Design variables -** the parameters of the design which can be changed to meet the requirements.
- **Design constraints -** a restriction of the design which does not add capability but effects the implementation. Examples of these include the "-ilities" such as manufacturability, assembleability, reliability, availability, sustainability, etc.
- **Operational Scenario** - Description of an imagined sequence of events that includes the interaction of the product or service with its environment and users, as well as interaction among its product or service components. (ISO/IEC 2011)
- **Verifiable -** can be shown to be met by some user-approved acceptance criteria. The technical specifics of the test will be determined in the _system requirements_.
- **Indivisible (atomic) -** expresses only a single need and cannot be broken down further.
- **Traceable** - can be connected to its source and the artifacts derived from it, and this connection is clearly documented.
- **Solution-neutral -** avoids proposing a solution unless absolutely necessary (e.g., where the system is constrained by existing external factors such as connection to a standard fitting or power supply).

Part 1: Defining the Need (4 points)

Now let us apply our human centered design thinking.

1. (2 pts) Read the Project 1 document. Recall that your goal is to create a legged campus service robot that dispenses items, effectively meeting the needs of a specific user group. Think of a specific user or group on campus which you will design the robot for (Babies, Students, UIUC Faculty/Staff, Individuals with arthritis in their hands, etc.).

    a. Find one or two online sources to inform you about this user's or group's needs (a news article, a post, a video, a research article, etc.) and cite it in the space below.

1. Journal Article (PDF hosted on Digital Commons)
Choi, H. (Hailey), Joung, H.-W. (David), & Choi, E.-K. (Cindy). (2025). Food delivery robots on college campuses: Understanding consumer perceptions and value dimensions. ICHRIE Research Reports, 10(3), Article 2. https://doi.org/10.61701/883003.788
2. http://starship.xyz/press/national-study-of-more-than-7000-college-students-shows-delivery-robots-help-students-feel-safer-skip-fewer-meals-and-improve-their-mental-health/

    b. Use a point-of-view statement to focus on an actionable problem and set the scope of work. (Recall: "___**user**___ needs a way to have ___**dispensed item**___ delivered because of ___**surprising insight/motivation**___.")

    Example: Professors on campus need to have K-Cups delivered quietly so that they can have their coffee and continue to focus on course development without distractions.

Campus students need a way to have food delivered on time so that they can avoid the anxiety of not receiving their orders due to unpredictable traffic situations.

Campus students need a way to have delivery robots look a little bit cooler so that they can share them on their social media.

Campus professors need a way to have delivery fees be as affordable as possible so that they can bear the cost of using the service.

Campus professors need a way to have delivery robots not spill soup so that their food can arrive stable.

2. (2 pts) Now that we have our user group identified, consider the user's needs that you as a designer want your user to experience as they interact with your design. If you are stuck, consider the point-of-view statement you completed in the previous question. Describe the user's needs that must be met and why in 3-5 sentences.
Example: Students should have their packages delivered to their dorm door. They should feel comfortable knowing that their package was delivered without fear of someone stealing the robot. Students also need the package to be delivered quietly, so they can focus on studying without interruptions.

Campus students need their food delivered **on time** to give them a sense of security and alleviate the anxiety of waiting. They need the robot to navigate the complex campus environment stably so that their food is not spilled, ensuring it arrives intact and delicious. Furthermore, they desire the robot's design to be unique and visually appealing to satisfy their social need to share novel experiences with friends.

Part 2: User/Stakeholder Requirements (10 points)

The user/stakeholder requirements document is a tool for communicating with the users/stakeholders to ensure that their needs are adequately represented.

We are going to refine and build on our answers from Part 1 above.

3. (1 pt) We have already identified the user group for our design. When we think about that user group, what are some key design requirements for anything that group will interact with?
Example: Anything designed for small children should not have any small pieces that could be swallowed and pose a choking risk.

When we think about the user group—campus students and professors—a key requirement for anything they interact with is convenience. Their lives are often busy, so any design should be easy to use and not require significant time or effort. For professors, reliability is also paramount, as they rely on predictable systems to maintain their schedules.

4. (1 pt) We also know what types of user needs we want our design to meet. What are some requirements for any design that is supposed to cause that emotion?
Example: A design that is supposed to be loud should make a lot of noise.

For a design meant to evoke feelings of security and convenience, it must be predictable and reliable. It should consistently perform its function without error or

complication. To create a sense of excitement and social shareability, the design should possess unique aesthetic qualities that stand out from conventional products.

5. (3 pts) Based on all of your previous answers, list 3 key capabilities or requirements.
Example: The design should be easy for a child to operate.
The design must contain rapid motion to convey excitement and energy.
The design should be colorful and bright.

1. The robot must deliver food on time
2. The robot must be visually unique and aesthetically pleasing.
3. The robot must stablilize its contents to prevent spilling.

6. (3 pts) We now need to translate from the key design **capabilities and user needs** to an **activity** that our design will perform. Create a list of a few activities or scenarios that might elicit some of the key needs you listed in the previous questions.

Example: A robot to cheer up babies should be whimsical and fun.
1. A student uses a mobile app to track the robot's real-time location, showing it's on a direct path to them and will arrive within the estimated time. This directly addresses the need for timeliness and alleviates anxiety.
2. The robot navigates over a curb and a bumpy campus sidewalk without any noticeable shaking or tilting of its internal container. This demonstrates its ability to stabilize contents and prevent spills.
3. When someone tries to steal the package and food, the robot warns him not to do like that because it must be satisfy the face recognition.
4. The robot arrives, and its hatch opens with a gentle light and sound effect, revealing the food. The student takes a picture of the unique robot for their social media, satisfying the need for a cool, shareable design.
5. The professor, seeing the robot has arrived outside their office window, unlocks the delivery with a single tap on a virtual key in their app. The robot's side panel slides open, and a secure internal drawer extends with a quiet, controlled motion, presenting the still-warm bento box without any jolt or spill.

7. (1 pt) What are some common characteristics of the activities that you have proposed?

Example: Each activity proposed requires two or more characters to interact.

Every activity requires interaction between robots and users. From start to finish, it should offer consistent comfort for the users.

8. (1 pt) Are there characteristics that are not present in any of the ideas you proposed?

Example: None of the activities are scary or frightening.

The robot doesn't actually know how to take an elevator or open a building's door if it is locked and requires authorization.

Part 3: Idea Sharing and Sketching (6 points)

Be prepared to share your answers to both questions 9 and 10 during lab.

9. (3 pts) Stakeholder requirements checklist

- Begin by copying your point of view statement (from question 2), and copy your a set of key capabilities (from question 5) in the blank space below. Also add any design constraints that may affect the design, including the physical requirements provided in the project 1 document.

Point of view:

Campus students need their food delivered **on time** to give them a sense of security and alleviate the anxiety of waiting. They need the robot to navigate the complex campus environment stably so that their food is not spilled, ensuring it arrives intact and delicious. Furthermore, they desire the robot's design to be unique and visually appealing to satisfy their social need to share novel experiences with friends.

Key Capabilities

1. The robot must deliver food on time
2. The robot must be visually unique and aesthetically pleasing.
3. The robot must stablilize its contents to prevent spilling.

Design Constraints
1. The dispenser should hold at least 5 objects to be dispensed, each weighing 25 g or less.
2. hand-cranked,
3. entire body should fit a standard shoebox.
4. Fully mechanical.

- Use the **stakeholder requirements checklist (Found on Canvas),** and Table 1 (below) on examples of poor and better articulated user requirements to iteratively refine your requirements. List your improved stakeholder requirements below.

1. The robot must deliver food in a detailed manner and can be seen on the app. It should notify the user of the total delivery time and find the best route to avoid obstacles, providing the estimated time of arrival and the delivery routine while the user is waiting.

2. The robot should have a well-designed surface

3. The robot should include a face recognition function.

4. The robot should have a suitable compartment to hold all the food and packaging, ensuring stability.

5. The robot must not jostle the food out of the bag; it should extract the packages from the bag smoothly and steadily.

10. (3 pts) Sketches:

- **Create 5 sketches** of the activities you describe in question 6 and place them below. If you feel that these original ideas will not meet the requirements you just created, feel free to sketch new ideas. These sketches do not need to be perfect, but if you are not confident in your sketching abilities, a good resource can be found here.

Graph 1 | Graph 2 | Graph 3 | Graph 4 | Graph 5

Table 1. Example of poor and better articulated user/stakeholder requirements

Examples of poor and better articulated user/stakeholder requirements:	
POOR	BETTER
1. The distributor and customer shall be able to easily load and unload the package to expedite the exchange and create positive customer experience. • "Easily" is not yet verifiable • Not yet indivisible (atomic)	1.1 The time required for loading and unloading by the distributor should be less than the current process. 1.2 The process of retrieving a package from the system should take a new user no more than 30 seconds on the first try.
2. The joystick should be user-friendly • Not solution-neutral • "User-friendly" is not yet verifiable	2. The control scheme should use common conventions to reduce learning time.

3. The distributor shall be able to verify that the package is secured before initiating transport. • Not yet indivisible (atomic) • Not solution neutral	3.1 The distributor shall be able to verify that the package is secured. 3.2 Transport should only begin once initiated by the distributor. • This still assumes a solution, and should only be included if this is a constraint specified by the stakeholder