

Architectural Thinking for Intelligent Systems

Assignment for Lecture A4

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“Our shopping robot contains a QR scanner, where the user can scan and login to their accounts, access their shopping list, UI where users can see the bill of the items in the cart, and also payment directly from the bank account linked through the user profile.”

Part 1: Stakeholders

Outside the Developing Organization: Customer, Local store manager, Company manager, Tester

Developing Organization: Development manager, Marketing (either here or from the company itself), Sales manager

Project Team: Designer, Developer, Business Analyst, Tester, Quality Manager, Hardware engineer

Part 2: Aspects

Customer, Tester: Performance, Accessibility, Usability

Local store manager, Company Manager: Reliability, Security

Development Manager: Accuracy, Efficiency

Marketing, Sales Manager: Design, Usability

Designer, Developer, Hardware engineer: Environment, Requirements

Business Analyst, Quality Manager: Usability, Performance

Part 3: Constraints

Privacy constraints: The system should handle confidential data as user account details, bank account details.

Time constraints: The UI, payment should be very responsive and shouldn't take more than a second.

Stability constraints: The system should be stable, it shouldn't break in between, it should be durable. the legs for movement should be stable and in balance.

Weight constraints: The robot should be able to carry weight up to 15 kilograms.

Part 4: Functional requirements

1. **Carry shopping items:** the main function of a shopping cart is to carry shopping items of the user which can be up to 15 kilograms.
2. **Automated payment:** Automatic checkout and payment integration through the bank account associated with the user.
3. **Assistant the shopper:** Provide assistance like a shopping list, smart basket, weighing directly in the cart.

Part 5: Glossary

UI: User-Interface i.e a graphic design and appearance of the software, where users can login to their profiles, access their shopping list, make payments.

Developer: Software engineers who are responsible to write the code for the frontend and backend of the systems.

Security: Security refers to the protection of computer systems and information from harm, theft, and unauthorized use.

Payment: A system facilitates the acceptance of electronic payment for online transactions. Here the payment will be done automatically via the bank details the user has mentioned in his profile.

Performance: The amount of useful work accomplished by the system. Performance is estimated in terms of accuracy, efficiency, and speed of executing instructions.

Part 6: Qualities

User: Customer

Quality: Usability

The system should be easy to learn and easy to remember. It should be usable and fulfill its primary functionalities.

User: Store owner

Quality: Maintainability:

The system should be easy to maintain and adapt, fast charging, easy debugging of errors. Security

Some other qualities can be:

Availability

Scalability

Reliability

Security

Testability

Modifiability

Part 7:

1. **Shopping assistance:** showing the shopping list, check listing items from the, showing the shortest path to the products in the list. Finding products via the search feature.
2. **Automated checkout:** The customer doesn't need to be in a queue to proceed to checkout, they can directly get the invoice or see the bill amount in the UI integrated into the cart with the help of a scanner attached to the cart.
3. **Automated payment:** The payment will be automatically done when via the bank account registered by the user during profile creation. When the person is ready to checkout, he can select the payment option from the UI.

The improvement over time by learning:

1. **Shopping Assistance:** The assistance will learn from the pattern of usage by the customer, and improve its performance to finding the shortest path.
2. **Automated payment:** Since the product collects a lot of diagnostics, error messages, and recovery logs, it helps to finetune the performance and reduce the error and calculation errors.
3. Since the product is data-driven, we will constantly monitor and collect the data to improve efficiency and overall accuracy.

Part 8: Architectural decision

Alternatives: legs, wheels, conveyer belt.

Concerns:

1) Wheels: Can move in flat terrain but not useful for different surfaces or terrains like stairs. Need to implement a stopper.

2) Legs: suitable for almost all kinds of terrains, need to be stable and maintain balance while walking or climbing stairs, etc. A lot of training will be required to train the robot to move efficiently.

3) Conveyor belts: Proper installation required, it's not flexible and very difficult to expand. Also, this alternative will take the longest time.

Outcome: The most superior one for our system is **legs**.

Rationale: One of the most important parts of the robot is mobility, and we expect it to be functional in many types of terrains rather than just a plain smooth surface. The shopping stores can be multi-stored so that robots should be able to be used in staircases. Using legs, it can be later trained to adapt many different functionalities.

Part 9

The following can be the relevant risk associated with these alternatives:

Legs:

1. Have to train for all types of terrains.
2. Stability and maintain balance.

Wheels:

1. We would need a braking system to stop it from rolling on inclined surfaces.
2. Gets stuck (need smooth surface)

Conveyor belt:

1. Time taken is very high (need to complete the whole cycle)
2. Installation is difficult and not adaptive.

Part 10

The force behind our decision for legs are:

1. **Stability:** should be stable to use
2. **Adaptability:** It should adapt to any kind of surface or terrain or type of environment.
3. **Reliability:** should be able to work 24/7
4. **Path:** should suggest and follow the shortest path possible.

Part 11

Further decisions that must be taken if we consider legs:

1. **No of legs:** should we consider 2 or 4 legs.
2. **The number of joints and movable parts:** So that the robot can move in any direction.
3. **Grip design and materials:** Textured pattern with good grip material need to be used.