

Project P

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Vending Machines: Interface Selection

You must have encountered vending machines in metro stations, schools, corporate parks or in big crowd space areas. I remembered my first experience recently with the vending machines, I was in office and it was a late night and I was feeling hungry. The cafeteria was closed, but I saw vending machines with snacks inside them. It looked somewhat like in figure 1. It typically consists of alphanumeric digits, a credit card reader, a small LED reader, and a small area to insert cash.



Figure 1: A typical vending machine. Left: Vending machine. Right: a credit card reader in a vending machine

Heuristic Evaluation

A vending machine can be of various designs. In this paper, I am going to discuss the design of a more traditional vending machine as shown in figure 1 above. A typical flow for purchasing a product using the vending machine would involve certain steps:

1. Decide which product you want to buy.
2. Decide how you want to pay, cash or credit card.
3. Insert cash or credit card in the slot.
4. Enter the productId in the panel and enter
5. Receive the product and do not forget to take your credit card back.

What works well?

Consistency, Discoverability, and Equity

For one of the things that work well for sure is the **consistent** performance of the vending machine. If you know the steps to purchase a product, then you will be able to purchase the product. This is one of good thing despite the environment in which the vending machines are put like sports center, colleges, corporate park where the machines are open for rough usage as there is no human there to maintain the machine.

Discoverability of various products that one seeing through the glass window is one of the most important features of the vending machine. If one is not able to see clearly what is inside the vending machine than the whole design is failed, yet the traditional design is perfect to overcome this challenge by providing a simple glass and marking each product in the specific place in form of multiple rows.

The design also has a feature of **equity**, where no matter who the user is, one is bound to receive the same experience. Whether it is a novice or an expert the vending machine experience will work the same for them in terms of operations of performing the tasks. The design of the vending machine is as such no matter if you memorize the labels for each product, you will find a different label in a different machine for the same product, so no one can actually become an expert user in the vending machine experience.

Also, I find the vending machines quite **durable** also. In my college, I am seeing the same vending machine for the past 8 years, and I think the reason behind it is its simple design and consistent behavior no matter who the user is. If you know the steps to buy a product you will see your selected product fall into the pickup area and know when it is available to pick up.

What does not works well?

Gulf of Execution and gulf of evaluation

The biggest flaw or disadvantage I see in the vending machine is in the **Gulf of execution and gulf of evaluation**. The Gulf of execution is certainly very large as a user have to reference the number written in the product and type it using the alphanumeric keyboard. The user knows which item he wants to buy, but he has to reference the number lets say “A123” or “B24” and type this number in order to buy the product.

As the user types the number, he constantly needs to reference the number which not only increases the **gulf of execution** but also increases the **cognitive load on** the user. This is problematic to the users who have eyesight problems. It does not make sense to let the user type a number when he knows which product he wants to buy.

The increase in the **cognitive load** can be worsened when a user wants to buy multiple items because now he has to type or memorize multiple reference numbers in order to buy those products, which significantly increases the number of the button press.

Similarly the **gulf of evaluation** as well can be very long here. When a user enters a product reference number it is sometimes not clear if the machine is taking the input or not. Sometimes the number is visible in the LED screen when the user types or sometimes the machine beeps when the number is entered successfully. These are the insufficient parameters which weaken and sometimes confuses the user when typing using the keypad.

Also, if a user is paying using the credit card or debit card, I have seen the reader sometimes is very slow, there is no way to know if you have swiped your card correctly and whether your transaction has happened successfully, and the reason

for the failure might be due to the slow network connectivity but nevertheless the user experience here gets affected.

Direct Manipulation and Invisibility

The design is not a very good example of **direct manipulation** because of the multiple steps involved to purchase a product. The reason for this lack of direct manipulation is due to the design model of referencing the product and pressing those numbers in the keypad. This makes this design violates the principle of direct manipulation. You cannot just put your hands through the glass and pick a product rather it involves pressing of the buttons on the keypad.

Tolerance and Perceptability

The problem with the product labels in the vending machine is that they are sometimes confusing as the labels for the product in a row only differ by the 1 number, for example, 2 products in a row one after another will have a label like “A12” and “A13”. Now a person entering this number in the keypad could easily misspell or miss press the digit in the keypad and that leads to the purchase of a different product and the whole purpose fails here.

So the **perception** of the products and their labels fails. Even once the user misspells or miss press the buttons in the keypad, there is no way for the rollover. Once is the number is entered and the credit card is swiped, there is no way to roll back the error. There is no confirmation is asked as if this is the product you finally want to purchase, and there the principle of **tolerance** is failed.

Interface Redesign

The new interface design will be based on the touch screen panel embedded in the glass to interact with the product directly. The redesign considers all the things that work well and that doesn't into consideration. For example, consider the following wireframes

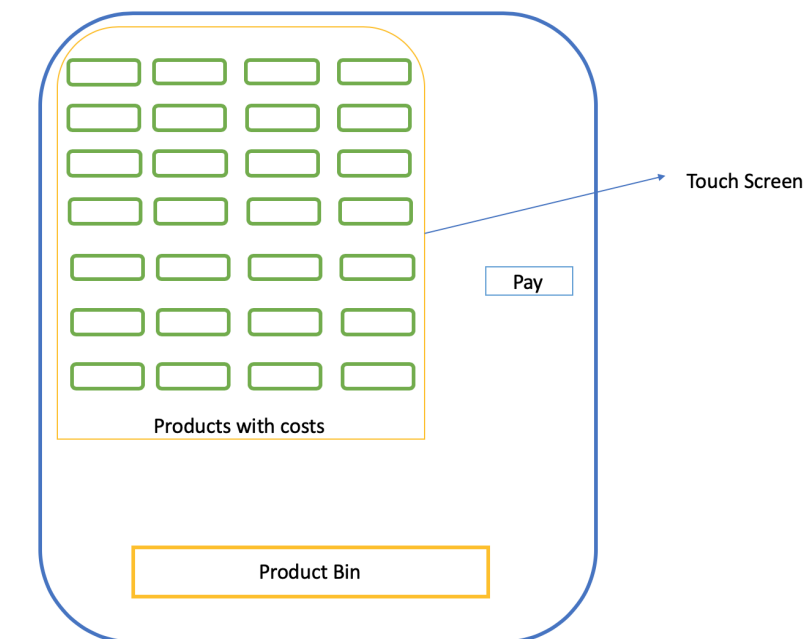


Figure 1: Generic vending machine dashboard redesign

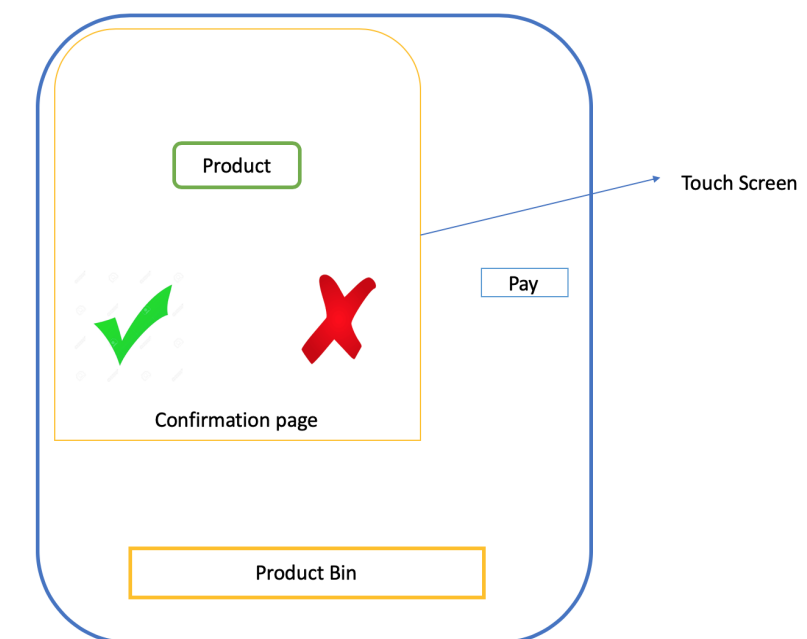


Figure 2: Confirmation of a single item/product

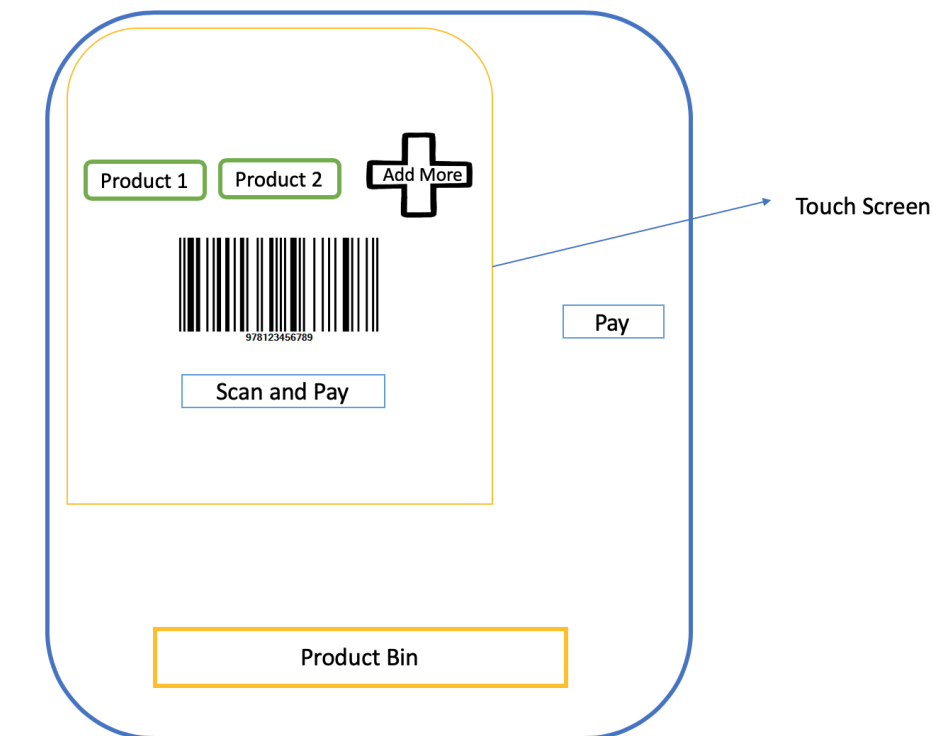


Figure 3: Options for payment screen or to add more product in the redesign.
Observe the 2 different payment options

Interface Justification

Redesigning Interface

In the redesigned model, we replaced the traditional glass screen with the touch-sensitive LCD panel which preserves the view to visualize different product along with interaction with the products. The largest benefit of the touch screen is that it is dynamic and can display all the necessary information to address all the critical elements in the design. In this design, the user can see the actual product and touch that product to display the necessary information or screen to continue his purchase. Secondly, it removes all the unnecessary panels like the keypad, LED panel, cash slit, etc.

As per the figure 1, the user can select the product from the LCD touch panel, and from there taken to next screen as shown in figure 2 where the user needs to

confirm whether he wants to buy that product. Then in the next screen, as shown in figure 3, the user can either pay for the product from there as the total price is shown there, or he can add more products. Once the user decides that he wants to pay then he can pay either via phone by scanning the barcode in the screen or he can pay using the credit card.

Gulf of execution and Gulf of evaluation

The Gulf of execution is certainly reduced with the redesign due to the touch LCD panel as now the user does not need to memorize or press the individual characters on the keypad, rather now the user just has to select the product he wants to purchase. A single touch and the item is added to your cart. Here there can be 2 options I think, one is that we show the user in the touch LCD panel the pictures of the product (figure 1) to distinguish clearly the different product and another option is to make the touch LCD panel transparent so that the user can see the real product and when they touch the product area on the screen then it invokes the confirmation page (figure 2). The lack of typing or pressing long product id or label makes the new design efficient and shorter to execute.

It also reduces the **cognitive load** from the user as now the user does not have to focus on the labels of product ids, rather it is not single touch on the panel to select a product, and the bigger benefit is that now user can simply add more product by simple touch which reduces the cognitive load from the user.

Just an additional point to consider here is that if the product id or label is 1 digit than there is not much improvement in terms of evaluating the gulf of execution quantitatively as touch also need 1 press. But I would say that this effect would not be big in comparison to the reduction of cognitive load from the user.

The redesign also shortens the **Gulf of evaluation**. The user here will know that the screen is behaving properly or receiving inputs whenever he performs an action in the touch screen because the screen changes to the confirmation of the product and ask the user to proceed to the payment page. There is no chance of mistyping or not receiving the feedback from the machine. One of the biggest advantages of having a touch screen is that it is programmable and you can show necessary information to the user like the number of the product he has selected and a new

item to add and the payment facility all adds up to the **easy comfortable experience** for the user.

The payment process also offers 2 options to the user. The traditional method is there as it is to pay using the credit where the user can swipe the credit card and pay. The touch screen can showcase the loading of the card, failure of the payment in the screen, which supports the **Gulf of evaluation** of this task. However, having said that we have discussed before that it happens many times that due to loss of a packet of lack of network connectivity there are chances of failure of payment is more here. So, it is better to support another mode of payment where the user can simply scan the barcode from the screen and pay from the mobile phone as there are many wallets and other options are available today.

Direct manipulation

The touch screen LCD panel here offers direct interaction between the product and the user. The user can virtually grab a product and add to his basket and proceed to payment directly. Removing the plain glass panel and replacing it with touch-based panel does not add any complexity, rather provides a **directness** to interact with the product.

Design principles Revisit

Discoverability, Equity and consistancy

The original design violates the principle of **discoverability** in various areas. The redesign adheres to this principle. The LCD touch panel is designed in a way to show you all the items along with their cost. There is no concept of labeling or marking an item here. The touch screen shows the information dynamically about the items in the stock, and keep the count so that whenever an item is finished it can showcase the message that the product is out of stock. Things are pretty **discoverable** and **perceivable** now in this design.

With this redesign, the touch screen can group together the similar items as well, so that a user does not have to scan through all the rows to find the item he is interested in. with the touch screen the user can quickly glance over a product and

see all the same category items all together. There can be icons or **signifiers** to mark the categories for different groups.

The new design also supports the principle of **equity**, and it is better in this design. The user experience will be the same for all the users in this case as well, however it will benefit to those as well who are disabled like low vision people who may have difficulty finding their products or reading the labels in the traditional vending machine, but with the new redesign they should be able to easily follow and see the product they want to purchase. In addition, there can be other supports that can be added like adding options for the colorblind people so that when they see the screen they can also visually distinguish the various products.

And **in contrast** to the previous where it is impossible for a user to become expert in operating the vending machine here in the redesign, it is possible as now there are no different labels to note down. With more practice, a user can easily learn to purchase his product much faster. He can add or save his card details on the phone so that the payment is faster and he can know very well what all categories and how to browse efficiently. There can be a search bar which can be used by the expert users to quickly browse through their products.

The redesign is not consistent however because the different vending machine can have different touch screen panels and a different software program running in them, which could make it inconsistent. However the process of selecting a product, payment option, confirmation box will remain same but the user experience may differ. If all the vending in the world follows our redesign then I believe we will not have the consistency issue as well, but if one vending machine supports this design and another supports different design then it is impossible to support consistency.

Tolerance

I believe tolerance is one of the biggest advantage we have here in comparison to the traditional vending machine where it is inevitable to roll back once you mis select a wrong product. But with this redesign the user can always see the confirmation page to confirm using the green tick or to cancel using the right tick, and in case of payment there is no chance if the payment fails and user does not know. The screen shows the loading and the transaction summary in the screen so that the user is aware about any error or failovers.

Finally, With the new redesign I hope the user experience will be enhanced and it will be easier and quicker to purchase the products from the vending machine without having to wait for so long to get a can of coke.