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VUW-Acme Vending Machine - System Description (2020)

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1.0 System Description of the VUW-Acme Vending Machine

The vending machine dispenses snacks.

1.1 Vocabulary

This vocabulary is sourced from https://vendinghow.com/article/filling-vending-machines-a-step-by-step-guide

Cart: The handcart you use to transport snacks to and from the truck.

Cases: These are the form in which the snacks are originally bought or delivered. A case of chips is usually a cardboard box of 64 chips. A case of soda is in a cardboard flat or box and is in a count of either 12, 24, or 36.

Coil: The metal spiral in a column that holds snacks and rotates to vend snacks (see Figure 1).

Figure 1: A coil from a vending machine

Coin box/Cash box: This removable box is where the coins that customers insert into the machine fall, so you can collect them later.

Coin slot: The slot where the customer puts coins into the machine in order to buy snacks.

Column: The entire line of snacks of one selection. The coil winds through the column to hold the snacks.

Collection: The money that you collect from a vending machine.

Collection bag: The bag you use to store your collections when you service a machine.

Selection: One specific snack location. An example of a selection is 'A1', or, "The first selection on the top shelf."

Shelves: Horizontal sections in a vending machine. For a snack machine, you can usually pull out the whole shelf, like you can with a dresser.

Trays: Trays hold snacks and support a number of individual spaces. Each space has an auger that pushes outward the selected snacks (see Figure 2– note that a snack is a product)
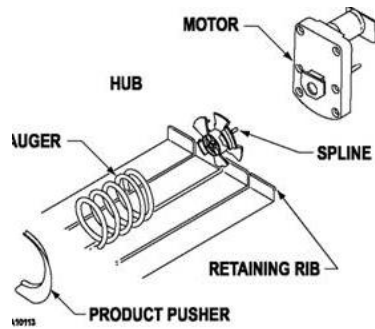

Figure 2: Motor & Auger

1.2 Physical system

On the assignment webpage is a document showing the physical system. There are two views – customer and operator.

Note that the operator is not the owner of the machine, they are hired by the owner to maintain the machine and collect money from it.

Customer view:

- Front of the machine is hinged to allow operator to access internal components after unlocking it using the keyless lock located in the lower right hand corner of the front of the machine.
- Operator enters a four digit key code into the keyless lock in order to open the machine. The keypad has physical buttons. The * key is used to clear any digits entered so far while the # key is used to submit the four digit code.
- Snack selector is a keypad with physical buttons. The customer enters a two character code corresponding to codes that appear at the front facing end of a column, for example "A5".
- Customer display is a LCD screen used to display the price of the selected snack.
- Coin slot allows the customer to insert $1, 50 cent, 20 cent and 10 cent coins.
- Coins return has a small recessed shelf to hold change or refunds.
- Snacks are displayed through a clear Perspex front wall and arranged on trays.
- Snacks are pushed to the front of the tray and will fall down a drop shaft created by the space between the end of the tray and the front wall into a takeout tray. The takeout

tray is covered by a flap that is pushed in to access to the item. While the flap is pressed in it is impossible to reach around to access snacks in the trays.

Operator view:

- Operator is hired by the owner of the machine to stock it and collect money on a regular basis.
- Embedded computer with a LCD operator display, physical keyboard and internal flash drive. The front of the embedded computer has four screws holding its cover on that holds the display and keyboard in place. The embedded computer cannot be reprogrammed.
- Coin box can be removed from the machine to allow the operator to gain access and fill the columns holding the coins used for change and also to receive payment from the user.
- Product holder allows access to the columns holding the snacks that are sold using the vending machine. The operator will fill the column from back to front with new snacks.
- Mechanical subsystem refers to the machinery used to validate coins and any systems responsible for driving the motor used to dispense snacks or motor used to cause coins to drop into the coins return tray.
- Coins are validated to determine if they are valid by measuring their weight and size.
- Power supply converts external power to correct voltage, current and frequency to drive the internal components of the vending machine. There is an off/on switch used so that the electronics are isolated from power when any maintenance such as on the mechanical subsystem or embedded computer take place. The power supply is a sealed unit.

1.3 Location of Vending Machine

The vending machine is located next to two other vending machines owned by competitors. The machines are located in the Cotton building in a corridor that is heavily trafficked between 9am and 5pm Monday to Friday.

The building is open from 8am-midnight seven days a week to allow students after hour access to laboratories and the library.

The vending machine is plugged into a wall socket that is behind the machine. This internally connects to the socket shown in the operator view diagram.

University security guards patrol the area twice a night between 5pm and midnight. They return at closing time to make sure that no students are remaining in the area and lock the main doors to the area. They will phone the operator if there is any visible damage to the machines.

1.4 Data flow diagram elements

On the assignment webpage there is a document showing the data flow diagram. Each of the elements show in the diagram are briefly listed below.

E1. Customer – a person who wants to buy snacks from the vending machine.

E2. Operator – a person who stocks the machine and collects the money (a collection).

D1. Snack table – a SQL database holding the snack description, its price and its location (row and column).

M1. Coins – coins stored in columns within the coin box.

M2. Snacks – snacks arranged in columns.

P1. Display snack selection. Looks up description of snack to display to customer using the customer selection and snack location data. Code executed by embedded computer.

P2. Display snack price. Looks up price of snack to display to customer using customer selection and snack location data. Code executed by embedded computer.

P3. Validate payment. Check whether the inserted objects are coins. Valid coins are deposited in the coin box. Check whether enough money has been inserted to purchase the snack. Trigger dispensing of the snack and return of any change due to the customer. Code executed by embedded computer.

P4. Extract coins. Return coins as instructed to the customer. Customer removes coins from coin return slot. Triggered either by Validate Payment or Dispense snack to customer. Code executed by embedded computer.

P5. Dispense snack to customer. Triggered by Validate Payment. Will trigger Extract coins if there are no snacks of the selected type available otherwise will dispense the snack to the customer by pushing snack out using motor. Code executed by embedded computer.

P6. Unlock machine. Check key code is correct and unlock machine. Mechanical system.

P7. Update descriptions, locations and prices. Receive updated information and write it to the snack table. Code executed by embedded computer.

P8. Collect money. Remove coin box, extract coins and place in a collection bag. Manual process.

P9. Open cases and fill machine. Snacks arrive in cases, open these and fill the machine. Manual process.

F1. Customer selection. Customer interacts with physical keyboard to enter selection.

F2. Snack description. Two way flow. Lookup and return of result is done via a function call internal to the embedded computer.

F3. Product information. Passed via a function call internal to the embedded computer.

F4. Product information. Entered via a physical keyboard.

F5. Selection. Passed via a function call internal to the embedded computer.

F6. Price. Two way flow. Lookup and return of result is done via a function call internal to the embedded computer.

F7. Selection and price. Passed via a function call internal to the embedded computer.

F8. Insert objects. Physically inserted into the coin slot and carried via a chute inside the mechanical subsystem.

F9. Valid coins. Carried via a chute inside the mechanical subsystem.

F10. Change due. Passed via a function call internal to the embedded computer.

F11. Selection. Passed via a function call internal to the embedded computer.

F12. Returned coins. Carried via a chute to the coin return slot from the coin box. Physically removed from the slot.

F13. Dispense snack. Analog signal along wire to motor that will push the snack out by motor into drop chute. Will return an analog signal if there is are no snacks remaining.

F14. Snack dispensed to customer. Snack falls down drop chute into tray at the bottom and physically removed from the tray.

F15. Refund. Refund details passed via a function call internal to the embedded computer.

F16. Release Coins. Analog signal along wire to motor that removes coins from coin box.

F17. Coins. Coin box removed physically from the vending machine.

F18. Collection. Coins removed from coin box.

F19. Cases. Cases physically unloaded from van and placed next to the vending machine.

F20. Unpacked snacks. Snacks physically placed in the vending machine.

F21. Lock key code. Entered via a physical keyboard.