# The Gas Station Control System

Dinoco is an American oil company operating thousands of gas stations. The system to be developed is the Gas Station Control System (or GSCS) that will be used to manage Dinoco gas stations.[1]

Gas stations allows customers to purchase gas (self-service). Some local businesses have billing accounts set up to receive a monthly bill, instead of paying at the time of purchase. There is always a cashier on-duty at the gas station to accept cash payments or perform system maintenance, as necessary. A customer has the option to be billed at the time of purchase, or to be sent a monthly bill and pay at that time. Customers can always pay via cash or credit card.

## Definitions

**Customer** The customer is the client of the gas station. Only registered customers can pay bills monthly. Name, address, telephone number and account number are the features that will describe a registered customer.

**Cashier** The cashier is in charge of the gas station. He accepts cash payments and performs system maintenance, as necessary.

**Credit card reader** The credit card reader is a separate piece of hardware mounted at each gas pump. The internal operations of the credit card reader are outside the scope of GSCS. When the customer swipes his or her credit card through the card reader, the card reader reads the

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[1] The gas station example is taken from: Travassos, Shull, and Carver, "Working with UML: A Software Design Process Based on Inspections for the Unified Modeling Language," Advances in Computers, volume 54, Academic Press London, 2001.

credit card number and sends it to the GSCS. If the credit card number cannot be read correctly, an invalid token is sent to the GSCS instead.

**Credit card system** The credit card system is a separate system, maintained by a credit card company. The internal operations of the credit card system are outside the scope of the GSCS. The GSCS sends a credit card number and purchase amount to the credit card system in order to charge a customer's account; the credit card company later reimburses the gas station for the purchase amount.

**Gas pump** The customer uses the gas pump to purchase gas from the gas station. The internal operations of the gas pump are outside the scope of GSCS. The gas pump is responsible for recognizing when the customer has finished dispensing gas, and for communicating the amount of gas and dollar amount of the purchase to the GSCS at this time.

**Gas pump interface** The gas pump interface is a separate piece of hardware mounted at each gas pump. The internal operations of the gas pump interface are outside the scope of GSCS. The gas pump interface receives a message from the GSCS and displays it for use by the customer. The gas pump interface also allows the customer to choose from a number of options, and communicates the option chosen to the GSCS.

**Cashier's interface** The cashier's interface is a separate piece of hardware mounted at the cashier's station. The internal operations of the cashier's interface are outside the scope of GSCS. The cashier's interface is capable of displaying information received from the GSCS. The cashier's interface is also able to accept input from the cashier, including numeric data, and communicate it to the GSCS.

## Requirements

The following functional requirements for the billing part of the gas station system were obtained from discussion with the customer:

1. After the purchase of gasoline, the gas pump reports the number of gallons purchased to the GSCS. The GSCS updates the remaining inventory.

2. After the purchase of gasoline, the gas pump reports the dollar amount of the purchase to the GSCS. The maximum value of a purchase is $999.99. The GSCS then causes the gas pump interface to query the customer as to payment type.

3. The customer may choose to be billed at the time of purchase, or to be sent a monthly bill. If billing is to be done at time of purchase, the gas pump interface queries the customer as to whether payment will be made by cash or credit card. If the purchase is to be placed on a monthly bill, the gas pump interface instructs the customer to see the cashier. If an invalid or no response is received, the GSCS bills at the time of purchase.

4. If the customer has selected to pay at the time of purchase, he or she can choose to pay by cash or credit card. If the customer selects cash, the gas pump interface instructs the customer to see the cashier. If the customer selects credit card, the gas pump interface instructs the customer to swipe his or her credit card through the credit card reader. If an invalid or no selection is made, the GSCS will default to credit card payment.

5. If payment is to be made by credit card, then the card reader sends the credit card number to the GSCS. If the GSCS receives an invalid card number, then a message is sent to the gas pump interface asking the customer to swipe the card through the card reader again. After the account number is obtained, the account number and purchase price are sent to the credit card system, and the GSCS and gas pump interface are reset to their initial state. The purchase price sent can be up to $10000.

6. The cashier is responsible for accepting the customer's payment and making change, if necessary. When payment is complete, the cashier indicates this on the cashier's interface. The GSCS and the gas pump interface then return to the initial state.

7. If payment is to be made by monthly bill, the purchase price is displayed on the cashier's interface. The cashier selects an option from the cashier's interface, alerting the GSCS that the payment will be placed on a monthly bill. The GSCS then prompts the cashier to enter the billing account number.

8. The customer must give the billing account number to the cashier, who then enters it at the cashier's interface. If a valid billing account number is entered, then the billing account number, purchase price, and a brief description of the type of transaction is logged. If an invalid billing account number is entered, an error message is displayed and the cashier is prompted to enter it again. The cashier must also have the option to cancel the operation, in which case the cashier's interface reverts to showing the purchase price and the cashier can again either receive cash or indicate that monthly billing should be used.

9. To pay a monthly bill, the customer must send the payment along with the billing account number. The cashier enters monthly payments by first selecting the appropriate option from the cashier's interface. The GSCS then sends a message to the cashier's interface prompting the cashier to enter the billing account number, the amount remitted, and the type of payment. If any of these pieces of information are not entered or are invalid, payment cannot be processed; an error message will be displayed, and the cashier's interface will be returned to the previous screen. If the type of payment is credit card, the credit card account number must also be entered, and then the paper credit card receipt will be photocopied and stored with the rest of the year's receipts.

10. Unless otherwise specified, if the GSCS receives invalid input it will send an error message to the cashier's interface. The cashier will be expected to take appropriate action, which may involve shutting the system down for maintenance.

The following non-functional requirements were also identified:

1. The system must always respond to customer input within 5 minutes.

2. The system should be easy to extend, so that if necessary another payment option (e.g. bankcard) can be added with minimal effort.