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Sommersemester 2015

Softwaretechnik/Software Engineering

http://swt.informatik.uni-freiburg.de/teaching/SS2015/swtvl

Exercise Sheet 4

Early submission: Wednesday, 2015-06-17, 12:00 Regular submission: Thursday, 2015-06-18, 12:00

Exercise 1 – (Use Cases) (5/20 Points)

Recall the controller for power windows for cars from Exercise Sheet 3. We considered a special power window with an "Auto Full Close" function. The window has a regular button that can be pressed up or down and moves the glass accordingly, stopping at the bottom and top positions. If a certain threshold position close to the top is reached, the window closes completely by itself, to prevent the user from leaving a small, almost invisible slit between the window and the door frame that may cause rain to leak through.
For this exercise, consider in addition a common safety feature: an obstacle sensor detects when there is an object preventing the window from closing and stops the operation of the power window to avoid personal injuries and damaging the motor.

(i) Write the **use cases** for the power window. Indicate possible alternatives and extensions.

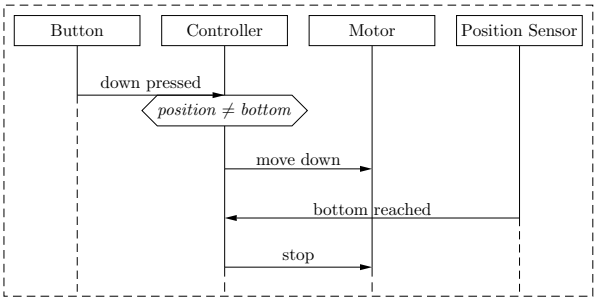
Hint: We think there are at least 5 goals that the user may have when interacting with the system. As use cases are based on natural language, provide a dictionary if necessary. (3)

(ii) Draw the corresponding **use case diagram(s)**. Describe the procedure by which you produced the use case diagrams from your use cases. What information is included in the diagram(s)? What information from the use cases is not? (2)

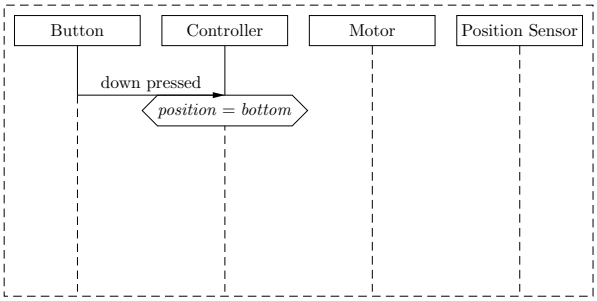
Exercise 2 – (Live Sequence Charts) (5/20 Points)

Consider the Live Sequence Charts shown in Figure 1, they specify scenarios and anti-scenarios for the use case "Lower Power Window". Using the charts 1(a) to 1(d) as base, give **universal Live Sequence Charts** that generalize and specify (your understanding of) the behavior desired by the customer.
Convince the readers that your solution is consistent in the sense that your solution (still) accepts at least one computation path for each of the positive scenarios required by charts 1(a) to 1(c), and that your solution does not accept the negative scenario described by the pre-chart of chart 1(d). (5)

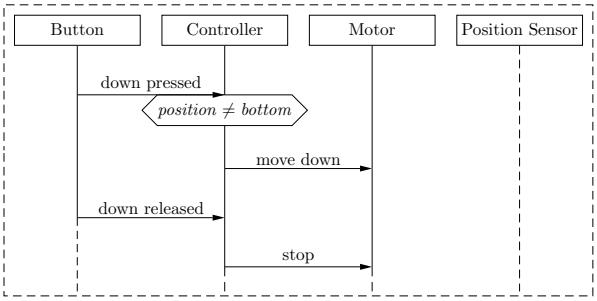
Hint: Universal charts make the behavior of the existential scenarios mandatory and forbid the negative scenario.



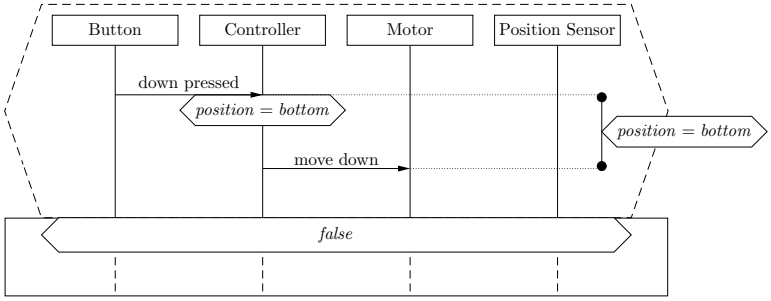
(a) The button is pressed in the down position and not released, the window reaches the bottom position.



(b) The button is pressed in the down position but the window is already at the bottom position.



(c) The button is pressed in the down position and released before the window reaches the bottom position.



(d) (negative scenario) It is never the case that the motor starts moving the window is the button is pressed in the down position when the window is already at the bottom position.

Figure 1: Scenarios and anti-scenarios for the use case "Lower Power Window".

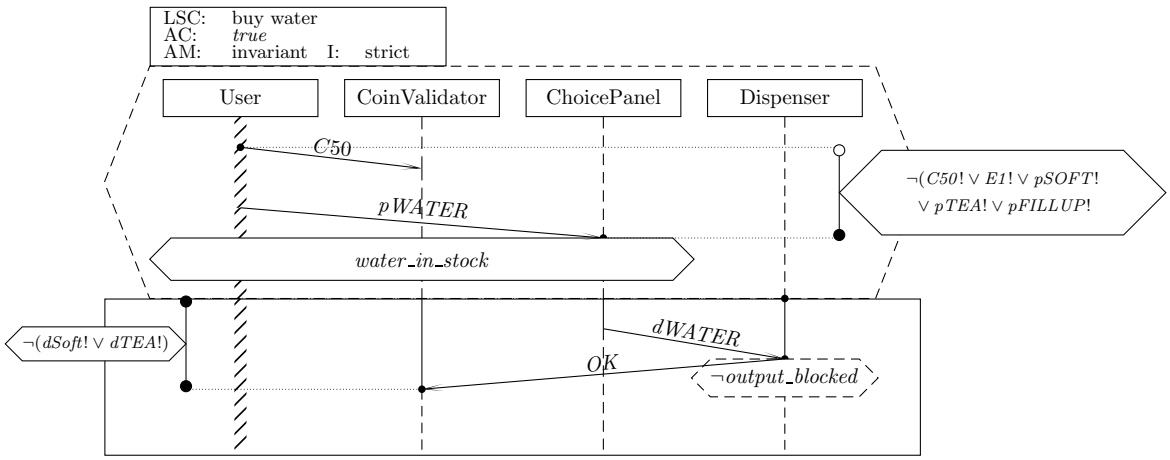


Figure 2: Buying water at the vending machine.

Exercise 3 – (LSC: Syntax and Semantics) (10/20 Points)

Consider the chart for the "buy water" function of the vending machine as studied in the lecture (cf. Figure 2).

(i) Write down the **abstract syntax** of the chart including the abstract syntax of the pre- and main-chart bodies. (2)

(ii) Compute the **Büchi automaton** for the pre-chart. Show the steps of your calculation: write down the **cut** for each state and the **fired sets** for each transition. (3)

(iii) Compute the **Büchi automaton** for the main chart. (3)

(iv) For each of the following cases, give one **example computation path** π: (2)

a) π non-trivially satisfies 'buy water', i.e. it fully traverses the pre-chart, thus activates the main chart, and is accepted by the main chart.

b) π violates 'buy water', i.e. it fully traverses the pre-chart but is not accepted by the main chart.

c) π trivially satisfies 'buy water' because π does not fully traverse the pre-chart since the automaton of the pre-chart "gets stuck".

d) π takes a legal exit, i.e. it fully traverses the pre-chart and exits legally during the main chart. Describe, in your own words and using your example, the intuition behind the concept of 'legal exit'.