CS 2310: Multimedia Software Engineering
Exercise 1

Mingda Zhang / miz44
mzhang@cs.pitt.edu

Requirement

The purpose of this exercise is to experiment with patterns in software engineering. (a) Use the IC cards to specify the activities involved in organizing a personal health care system such as processing sensor input from blood pressure meter, body temperature, heart rate and so on, scheduling routine and non-routine appointments with physician, obtaining and processing prescriptions, following up test results and so on. (b) Can you identify certain patterns from the above activities? Describe some of the patterns you have identified.

1 Activities involved in organizing a personal health care system

The general pipelines for organizing a personal health care system is shown below. The corresponding IC cards are demonstrated in the following parts.

- Schedule an appointment before going to the hospital
  - Schedule routine appointment
  - Schedule non-routine appointment (Emergency)
- Update medical records
- Examine patient symptoms
- Collect sensor data
  - Check blood pressure
  - Check blood sugar level
  - Check body temperature
  - Check heart rate
- Perform diagnosis
- Provide appropriate treatment
  - Prescribe medicines as treatment
    - Get to pharmacy for medicines
  - Get surgery as treatment
  - Transfer to higher level medical institutions

- Schedule follow-up test
- Handle Paperwork

IC Card IC Name: Schedule routine appointment

Description: Regular patients need to make routine appointments
Interaction Pattern:

By Others with Interaction

Time Critical Condition: none
Name of Other IC: Routine Appointment scheduling system
Message to Other IC: Request for making a routine appointment
Other IC's Task: Accept the request and assign a time slot
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Schedule non-routine appointment

Description: Patients in emergency need immediate treatment
Interaction Pattern:

By Others with Interaction

Time Critical Condition: as soon as possible
Name of Other IC: Emergency appointment scheduling system
Message to Other IC: Request to jump the queue and get immediate treatment
Other IC's Task: Accept the request and assign medical staff immediately
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Update medical records

Description: Update medical records for the patients
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: none
Name of Other IC: Medical records storage system
Message to Other IC: Request to update or add new records
Other IC's Task: Processing update request
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Examine patient symptoms

Description: Examine patient symptoms to help diagnosis
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: During the patient appointment time
Name of Other IC: Patients being examined
Message to Other IC: Inquiry about patient feelings and observed symptoms
Other IC's Task: Respond accurately according to the actual symptoms
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Collect sensor data

Description: Collect data from various sensors to monitor patient status
Interaction Pattern:

Mixed

Time Critical Condition: none
Name of Other IC: Multiple sensors
Message to Other IC: Request to obtain sensor data
Other IC's Task: Get certain data from patient and report back
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Check blood pressure

Description: Check the blood pressure of the patient
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: in a few minutes (to reflect current status)
Name of Other IC: Blood pressure monitor
Message to Other IC: Request for current blood pressure data
Other IC's Task: Detect patient blood pressure
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Check blood sugar level

Description: Check the blood sugar level of the patient
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: in a few minutes (to reflect current status)
Name of Other IC: Blood sugar level monitor
Message to Other IC: Request for current blood sugar level data
Other IC's Task: Detect patient blood sugar level
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Check body temperature

Description: Check the body temperature of the patient
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: in a few minutes (to reflect current status)
Name of Other IC: Body temperature metre
Message to Other IC: Request for current body temperature
Other IC's Task: Measure patient body temperature
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Check heart rate

Description: Check the heart rate of the patient
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: in a few minutes (to reflect current status)
Name of Other IC: Heart rate monitor
Message to Other IC: Request for current heart rate data
Other IC's Task: Measure patient heart rate
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Provide appropriate treatment

Description: Based on patient status give appropriate suggestions for treatment
Interaction Pattern:

Mixed

Time Critical Condition: During the appointment
Name of Other IC: Other medical staff and patients
Message to Other IC: Suggest various treatment to patients
Other IC's Task: Perform actual treatment
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Prescribe medicines as treatment

Description: Doctors give prescription list to patients
Interaction Pattern:

Mixed

Time Critical Condition: During the appointment time
Name of Other IC: Patients need to be cured
Message to Other IC: Detailed medicines needed to cure the disease
Other IC's Task: Go to pharmacy to get the medicines
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Obtain medicines from pharmacy

Description: Go to pharmacy to purchase medicines on prescriptions
Interaction Pattern:

By Others with Interaction

Time Critical Condition: The sooner the better (early cure)
Name of Other IC: Pharmacist in charge of pharmcy
Message to Other IC: Request for medicines listed on presriptions
Other IC's Task: Double check the list and provide the medicines
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Perform surgery as treatment

Description: If needed surgery is performed to cure patients
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: Before it becomes too late
Name of Other IC: Patients to be cured
Message to Other IC: Give details about performing surgery
Other IC's Task: Approve or reject such treatment suggestions
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Transfer to higher level hospita

Description: Patient in bad condition and needs to be transferred
Interaction Pattern:

Mixed

Time Critical Condition: as soon as possible
Name of Other IC: Emergency system in higher level medical institutions
Message to Other IC: Condition of the patient and the reason of transfer
Other IC's Task: Accept the patient and give immediate emergency care
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Schedule follow-up test

Description: Schedule follow-up test for patients if necessary
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: none
Name of Other IC: Doctors in charge of the patients and patients
Message to Other IC: Available time slot for follow-up test
Other IC's Task: Acknowledgement
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

IC Card IC Name: Handle paperwork

Description: Handling the necessary paperwork for billing and insurance
Interaction Pattern:

By Myself with Interaction

Time Critical Condition: Within the limit of insurance company
Name of Other IC: Insurance agents
Message to Other IC: Submit insurance request for reimbursement
Other IC's Task: Approve or reject reimbursement
Card 1 of 1 (If necessary please use several IC cards to describe an IC)

2 Patterns identified from activities

2.1 Complicated tasks can be decomposed for easier solutions

The most obvious pattern is the decomposition of complicated tasks. In fact, we notice that for many difficult tasks more than one IC Cards are needed because the goal can only be achieved by collaborations. For examples, in the personal health care system design, collecting sensor data is not trivial because more than one sensors are needed. To finish the task, we split the higher level tasks into smaller ones, aka. collecting blood pressure, blood sugar level, heart rate, etc. In this way the tasks can be handled by individual sensors and the results can be obtained from corresponding sensors. This pattern can be formulated in the following form.

Problem
Current patient status is needed to help the diagnosis

Context
Patient status is reflected by various data, like blood pressure, blood sugar level, heart rate, etc

Solution
Use multiple sensors to collect individual data

2.2 Agents collaborate and work together to solve tough tasks

We also notice that in complicated tasks more than one IC cards are needed to collaborate on one single task. In this case, it's relatively hard to define the interaction pattern from the given list. For example, when a patient in bad condition needs to be transferred to higher level medical institutions, not only the local doctors and patients are involved, the medical staff in higher level medical institutions are also needed to cooperate with the transferring. In addition, the billing system and scheduling system need corresponding information to correctly handle such situations. In this case, the interactions become much more complicated. This pattern can be formulated in the following form.

Problem
Patient in bad condition needs better treatment and needs to be transferred to higher level hospitals

Context
More than one agents are involved in the complicated situations and interactions are hard to define

Solution
Contact multiple agents to collaborate on the task

2.3 Prerequisites need to be completed before further tasks

Another pattern is that certain protocols need to be followed in a chronological order. Specifically, the general pipelines for the personal health care systems develops as “Scheduling” -> “Examine” -> “Collect essential sensor data” -> “Corresponding treatment” -> “Followup appointment” -> “Billing and Insurance”. Some procedures can occur in parallel, such as collecting various sensor data but the others are required to be performed in this order. For example, the treatments can only be determined when necessary examinations have been performed and necessary sensor data have been collected, because the decision are based on these test results. This pattern can be formulated in the following form.

Problem
Multiple procedures need to be completed and some are prerequisites for others

Context
Some activity relies on the result of previous activities thus it can only be decided when the prior results are available

Solution
Logically schedule the entire pipelines in a reasonable way