

Carleton University
SYSC3020 – Introduction to Software Engineering – Summer 2014

Lab 1 – Requirements Elicitation and Specification

This lab will concentrate on the process of requirement elicitation using UML Use Case Diagrams (UCD). From the description of a system, you are to identify actors and use cases, which you will specify in a UML Use Case diagram and in formal use case descriptions.

Attendance/Demo

To receive credit for this lab, you must make reasonable progress towards completing the exercises. When you have finished all the exercises, call your instructor or a TA, who will review your UML diagram. For those who don't finish early, the TA will start reviewing whatever you have completed, starting at about 15 minutes before the end of the lab period.

Finish any exercises that you don't complete on your own time.

UML tools

Many tools exist for drawing UML diagrams; for this lab (and the following), you can use Violet UML, MS Visio or Rational Rose.

Violet UML is a free open-source tool written in java, specifically made for UML diagrams, whereas Visio is part of the Microsoft Office suite and is a general-purpose diagram editor.

Rational Rose is a professional UML IDE used in a number of big companies, part of a greater suite of tools for software engineering. It will manage an integrated set of models and can generate code from diagrams, among other things.

Violet and Visio do not have all the bells and whistles provided by such high-end UML IDEs, but they are easier to use, and Violet has the advantage of being free.

For this course you can use whichever one you prefer. The instructions below will help you get started with the different tools.

Getting Started: Getting and Running Violet

Step 1: Create a new folder called sysc-3020-Lab-1.

Step 2: Download the executable jar file **com.horstmann.violet-0.21.1.jar** from SourceForge (<http://sourceforge.net/projects/violet>) and store it in your folder.

Step 3: Launch Violet by double-clicking on the icon for the jar file.

Step 4: Click on File→New→Use Case Diagram

Getting Started: Running MS Visio

Step 1: Open Visio (in the start menu)

Step 2: Click on File→New→Software→UML Model Diagram→UML Use Case

Step 3: Start by dragging the dropping the UML elements in the workspace

Getting Started: Running Rational Rose

Due to configuration issues the version of Rational Rose licensed by Carleton does not run on Windows 7. To run it, you have to use windows XP on a virtual machine.

Step 1: In the start menu, under “all programs”, find “windows XP”, and click on the program in the folder. This starts a virtual machine with windows XP for you. You will see a window open with an XP desktop, which works exactly like a computer running XP.

Step 2: In the start menu (of windows XP), you will find a menu of Rational Software, where you will find Rational Rose real-time.

Problem Description

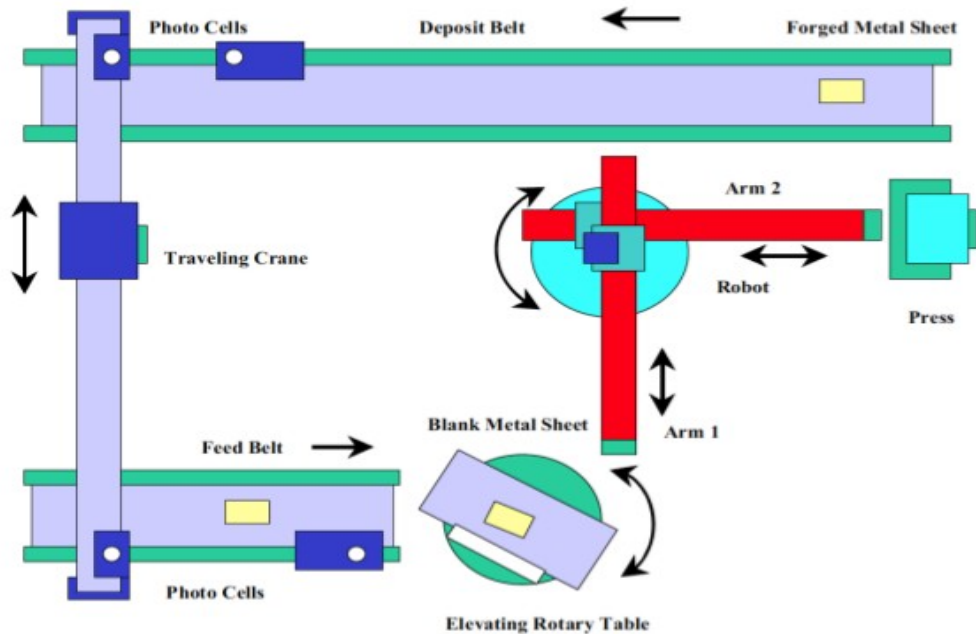
The following text describes the Production Cell, an industrial system to forge metal sheets, controlled by an embedded processor. You have to conduct the requirement elicitation for the embedded software controlling the different components of the Production Cell.

The Production Cell is a real system which purpose is to forge metal sheets: see the diagram below for an overall illustration.

rocessing a metal sheet starts with a blank metal sheet (illustrated in yellow) being conveyed by the Feed Belt (bottom left) to the Elevating Rotary Table. The belt is powered by an electric motor that can be started and stopped by the controlling software.

The responsibility of the Elevating Rotary Table is to take a sheet from the Feed Belt and put it in place for the robot to take it: the Feed Belt and the Robot’s first arm (Arm1) are at different heights and the robot does not move vertically, and a specific angle has to be reached because the robot arm does not have the capability to change the way its gripper takes the sheet.

The Robot has two arms: one (Arm1) picks up sheets from the Table and puts them in the Press; one (Arm2) picks up sheets from the Press and puts them on the Deposit Belt. Once a sheet is available (at the right height and angle) on the table, the robot rotates (if need be) and extends its first arm (Arm1), its gripper (magnet) picks up the sheet, and the robot retracts its first arm. Then, the robot turns



counterclockwise to position its second arm (Arm2) in front of the Press to pickup any sheet that may have been pressed.

To empty the Press, the Press waits in its lower (unloading) position until Arm2 extends, retrieves the forged metal sheet and retracts away from the Press. Because the Robot arms are located at different levels, the Press has three positions: In the lower position, the Press is unloaded by Arm2; In the middle position, the Press is loaded by Arm1; In the high position, the Press is closed, forging a blank metal sheet.

The Press moves its lower plate up to its middle (loading) position and waits for Arm1 to arrive and load the blank sheet. The Robot rotates counterclockwise until Arm2 points towards the deposit belt. Arm2 extends and places the forged metal sheet on the Deposit Belt and retracts away from the Deposit Belt. The Robot rotates counterclockwise to position Arm1 in front of the press, extends Arm1, places the blank sheet in the press, and retracts Arm1 away from the Press. The Press closes, forges the blank sheet, and opens again to its lower position.

The Robot rotates clockwise towards its initial position. The Crane receives a signal from a photoelectric cell, indicating that the forged metal sheet has arrived at the unloading area. The crane's gripper positions itself over the Deposit Belt and picks up the forged sheet. The Crane moves to the left until positioned over the Forged Sheets Container and then drops the forged sheet.

The crane continues moving to the left until positioned over the Blank Sheets Container, moves its electromagnetic gripper down, picks a blank sheet up, moves the gripper up and continue moving to position itself at the Feed Belt. The gripper releases the blank sheet on the loading area of the Feed Belt. The crane travels right back to the Deposit Belt.

The operation cycle repeats.

Questions

- 1) Identify the actors that the controller software interacts with. For each actor, provide a short description.
- 2) Draw a use case diagram that describes the functionalities that should be supported by the controller software. The use case diagram should include the actors you identified in (1). Show the relationships between the actors and the use cases and among the use cases if any.
To get you started, one use case and actor has been shown: extend it to include other use cases and actors. Provide a brief summary (1-2 sentences) of each use case in your diagram.
- 3) Provide a detailed description of 2 use cases, following the template of the provided use case description.

Sample of the Use Case Diagram

Actor “travelling crane”, use case “grip metal sheet”.

Actor: Travelling Crane

The travelling crane is used to load the feed belt with the blank metal sheets and unload the forged metal sheets from the deposit belt.

Detailed Use Case description: Grip Metal Sheet

Use case name	Grip Metal Sheet
Summary	The system aligns the crane’s gripper over the metal sheet
Precondition	The photoelectric cells have signaled the crane
PrimaryActor	Travelling crane

Secondary Actor	
Dependencies	
Basic Flow	<ol style="list-style-type: none"> 1. The System asks the crane to move its gripper to position on the metal sheet 2. The System VALIDATES THAT the crane is in position to grip the metal sheet 3. The System asks the crane to move the electromagnetic gripper down 4. The System asks the gripper of the crane to pick the metal sheet 5. The System asks the crane to move the gripper up. <p>Postcondition: The electromagnetic gripper has the metal sheet</p>
Specific Alternative Flow	<p>BFS 2.</p> <ol style="list-style-type: none"> 1. The System asks the gripper to position over the metal sheet 2. RESUME STEP 2 <p>Postcondition: The crane has been asked to readjust its gripper</p>