1. Introduction

This report discusses the design for the generation of a device independent user interface prototype for services offered by a digital library from an Integrated Scenario Specification using class diagrams and collaboration diagrams as input. The project was conceived as an extension to the SUIP tool, which generates a User interface in java. But this approach has an inherent problem. The interfaces thus generated have the java ‘look and feel’ and this can’t be changed if the user so desires. Our design overcomes this drawback by generating the interface in UIML which is device independent and thus it is possible to render the code in java, HTML, WML and other languages.

The report aims at providing details about the intricacies of the design and the tries to answer the common ‘how to’ questions to get the code running. In addition, it also lists possible enhancements to the code that could be taken up as future work.

2. Design and Architecture Details

Our project was to basically extend the functionality of the SUIP tool so that it generates the interface code in UIML. The following concept map shows where we concentrated our efforts in the whole SUIP scenario.

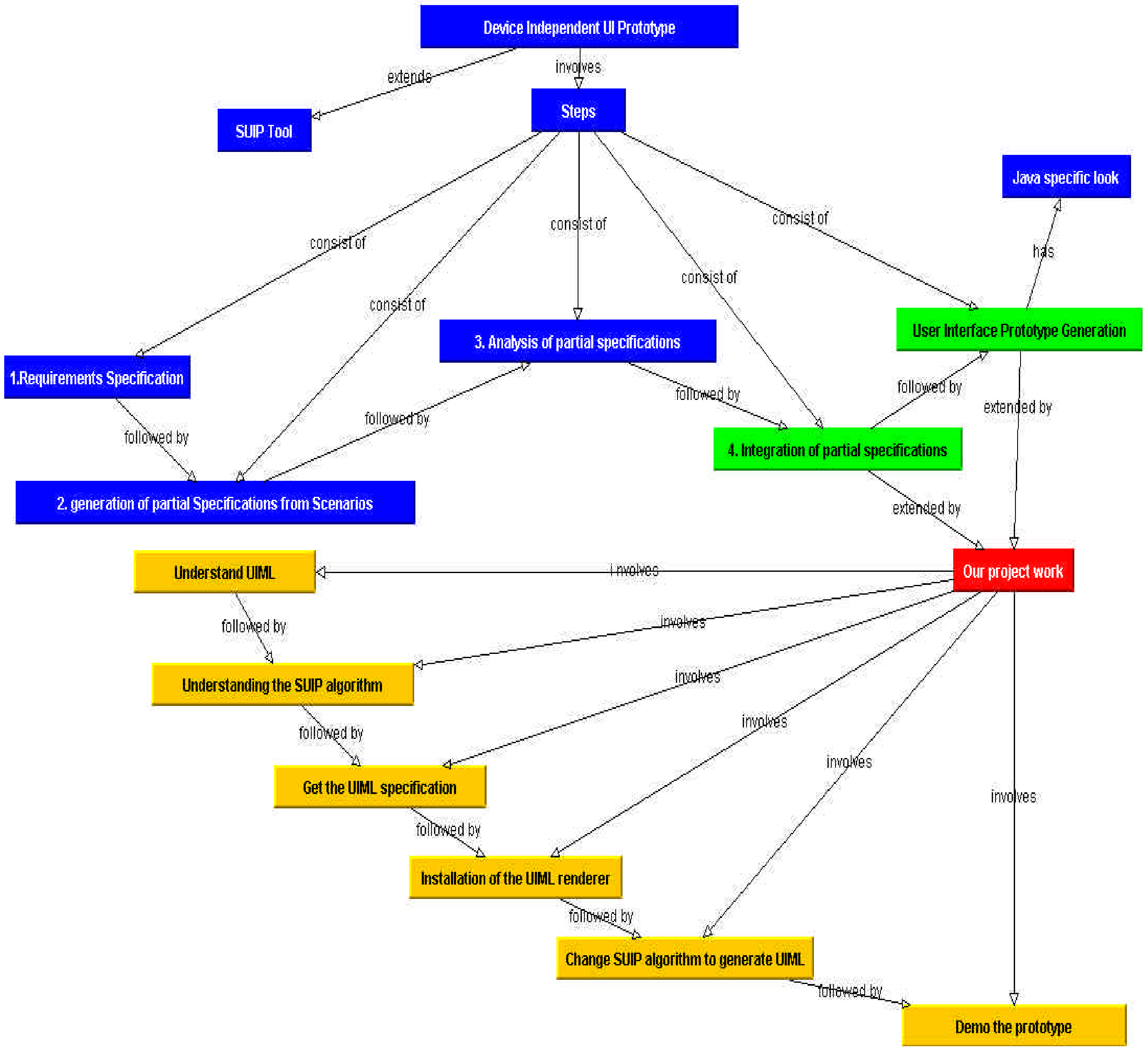

Device Independent UI Prototype
extends
involves
SUIP Tool
Steps
Java specific look
consist of
consist of
consist of
consist of
consist of
has
1.Requirements Specification
3. Analysis of partial specifications
User Interface Prototype Generation
followed by
followed by
followed by
followed by
extended by
2. generation of partial Specifications from Scenarios
4. Integration of partial specifications
extended by
Understand UIML
involves
Our project work
followed by
involves
Understanding the SUIP algorithm
involves
followed by
involves
Get the UIML specification
involves
involves
followed by
Installation of the UIML renderer
followed by
Change SUIP algorithm to generate UIML
followed by
Demo the prototype

Fig1: Project Concept Map

As seen in the concept map the project involved converting the partial specifications into the UIML code. To achieve this goal, we had to undertake several activities before getting down to writing code for the final deliverable.

We took the following approach to realize our objective:

1. Understanding the SUIP algorithm in order to understand where our design would fit into the code
2. Obtaining the latest UIML specification. (UIML v2.0 and v3.0)
3. Installing the UIML renderer. (LiquidUI)
4. Modifying the SUIP algorithm in order to integrate our design into the SUIP code.
5. Preparing a demonstrable prototype.

2.1 Problems Faced

We were faced with several problematic issues during the course of the project. Some were due to our assumptions and the others were due to the non-standardization of UIML. We have listed the hurdles that we faced below:

1. We started our design assuming that UIML had the ability to call functions across files. However, we couldn' t find such functionality in the specification. We thus had to abandon our initial design based on our assumptions. We decided to split the files into 2 types - .stat and .act files. The .stat files contained the UI part, which was static content. The .act files had the action listeners for the UI components. The final output is a single file which concatenates the .stat and .act files.
2. We realized that the UIML renderer renders only the older version of the UIML specification much later and by this time we already had the UIML code generated as per the latest specification. We ended up creating 2 deliverables so that we had a demonstrable prototype.
3. One more difficulty was getting the UIML renderer (LiquidUI) up and running. The documentation provided by the software is insufficient to do this. It took us some time to realize that the software required jdk1.1 (now obsolete) for the installation. However, the ironical part is that the same software requires jdk1.3 to run.

4. Finally, we had problems regarding the SUIP code obtained from the authors since the code provided had bugs. We had to debug this code before beginning our design.

2.2 Logical Flow of the Design

The code written for our project modified 3 files of the original SUIP code:

1. UIGraph.java
2. Util.java
3. SUIP.java

The UIGraph.java file is concerned with the generation of the .stat and .act files from the partial specifications generated by the SUIP code.

The Util.java file is concerned with the generation of the Main Window for SUIP and the Simulation Window, which shows the transitions between the states of the state chart diagram. The states correspond to the status of the UI components.

The SUIP.java file is the main application file, which starts the entire process and it contains the code for combining the .stat and .act files into a single resultant file "final.uiml".

2.2.1 Modifications Integrated into the SUIP Design

The following functions were integrated into the UIGraph.java file:

Function Name	Function Description
generateuimlFile	This function was created in line with our initial approach of creating multiple .uiml files which could call each other. This function creates a .uiml file with the initial headers. Code for generating the static content of the .uiml files has been written. However, the further development on this approach was abandoned because we couldn't find a way of function calling between .uiml files.

generateuimlLwidget	This function generates the UIML equivalent of the java label code.
generateuimlCwidget	This function generates the UIML equivalent of the java Checkbox code. Since the renderer didn' t support the checkbox group, we implemented this as a button group having radio buttons. This in effect had the same functionality as the checkbox group
generateuimlBwidget	This function generates the UIML equivalent of the java button widget
generateStatFile	This function creates the .stat and .act files. It however doesn' t populate the files.
generateUimlControllor	This function generates the UIML equivalent of the java action listeners of the various UI components. In our project, the action listeners correspond to button actions and menu actions
ActivateUimlWidgets	This function generates the comments on state transitions which are in turn displayed in the simulation window
DesactivateUimlWidgets	This function deactivates the UI components depending on the transition of the states in the state transition diagram
chooseUimlScenario	This function generates the UI for choosing the regular or the error scenario

The following function was modified in the Util.java file:

MenuForUIObject – This function was modified to generate UIML code for the main SUIP terminal and the simulation window.

The following modifications were done in the SUIP.java file:

Code was written to concatenate the .stat and .act files into a single UIML file "final.uiml".

2.2.2 Flow of Control in the Design

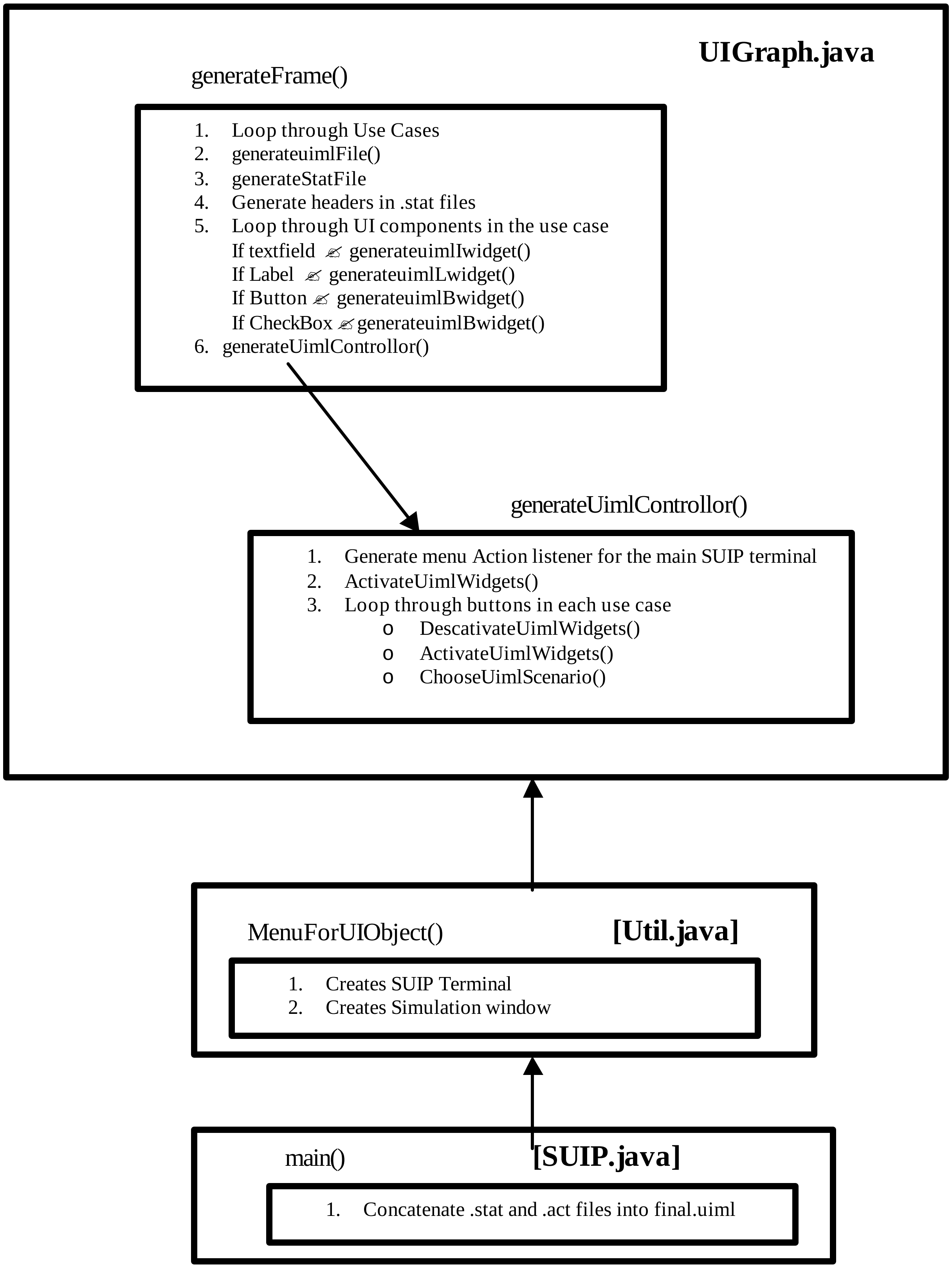

UIGraph.java
generateFrame()
1. Loop through Use Cases
2. generateuimlFile()
3. generateStatFile
4. Generate headers in .stat files
5. Loop through UI components in the use case
If textfield ✍ generateuimlIwidget()
If Label ✍ generateuimlLwidget()
If Button ✍ generateuimlBwidget()
If CheckBox ✍ generateuimlBwidget()
6. generateUimlControllor()
generateUimlControllor()
1. Generate menu Action listener for the main SUIP terminal
2. ActivateUimlWidgets()
3. Loop through buttons in each use case
o DescativateUimlWidgets()
o ActivateUimlWidgets()
o ChooseUimlScenario()
MenuForUIObject()
[Util.java]
1. Creates SUIP Terminal
2. Creates Simulation window
main()
[SUIP.java]
1. Concatenate .stat and .act files into final.uiml

Fig 2. Flow of Control

3. User Manual

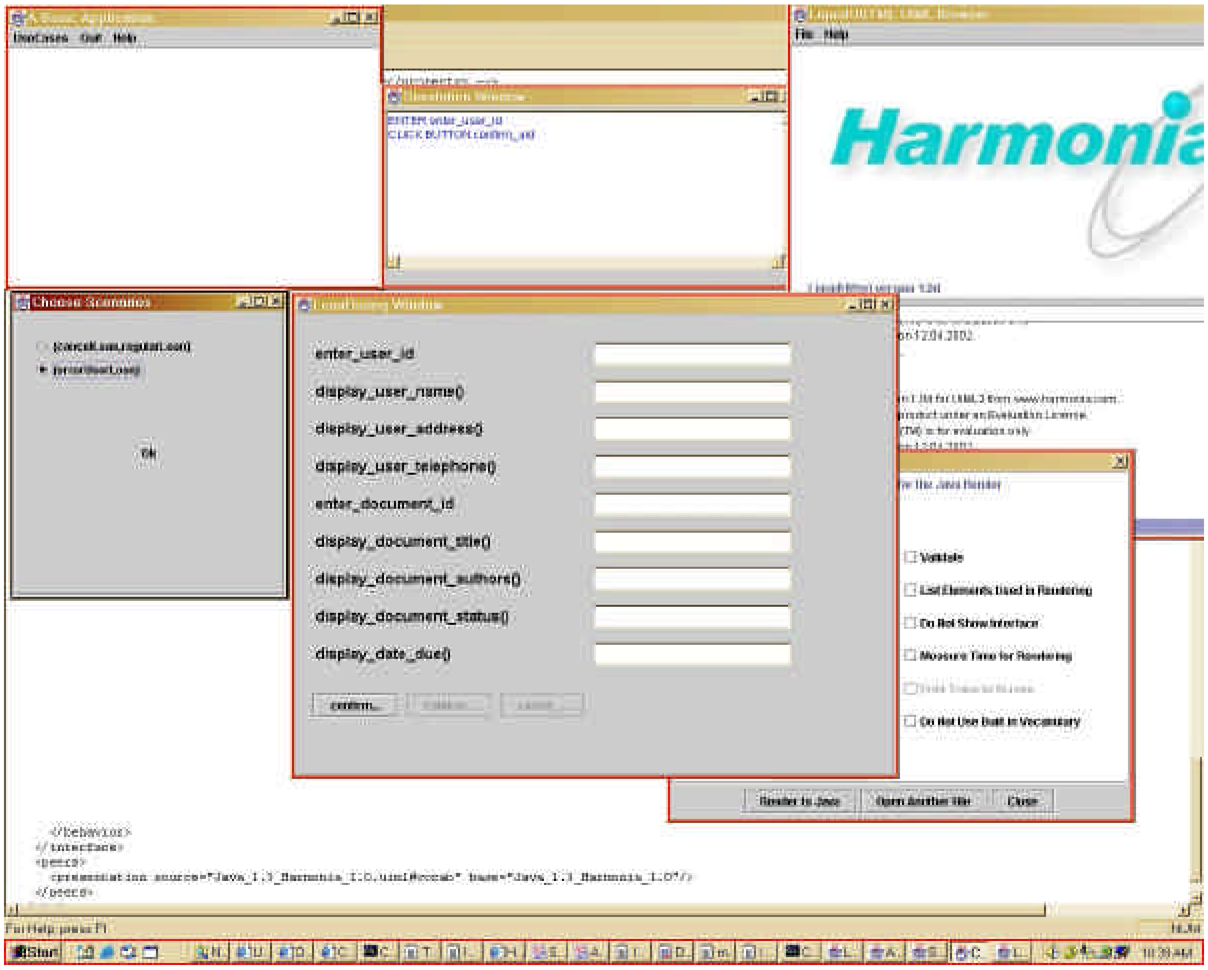
To use our deliverable following steps are to be taken.

1. Unzip the SuipSpec V2.0.zip to the destination folder
2. *(Note: SuipSpec V3.0.zip can't be rendered completely because UIML spec v3.0 can't be rendered by the renderer)*
3. Open a DOS window and go to the destination directory where the file has been unzipped
4. Go to the SuipSpec V2.0\libprj\UIObjects\Terminal directory
5. On the command prompt type :
6. javac *.java
7. java SUIP *classDiagramFile*
8. This generates the final.uiml file, which is the output file to be rendered. The file is created in the SuipSpec V2.0 directory
9. Download the UIML renderer LiquidUI. This can be downloaded at the following link
10. http://www.harmonia.com/products/liquidui/download.htm
11. Install jdk1.1 since it is required for LiquidUI installation. This version is obsolete but can be obtained from the archive at the following link:
12. http://java.sun.com/products/archive/index.html
13. Install jdk1.3 to run the renderer. This is a requirement by the renderer. The jdk1.3 can be obtained at the following link
14. http://java.sun.com/j2se/1.3/download.html
15. Once the installation is complete and the final.uiml file has been generated it is necessary to check if the vocabulary file(UIML2_0g.dtd) is present in the same directory. If not place this file in the same directory as the output file.
16. The file "final.uiml" is now ready to be opened by the renderer, which then shows the UI prototype.

Appendix A: Generated UIML code sample

```
<?xml version="1.0"?>
<!DOCTYPE uiml PUBLIC "-//Harmonia//DTD UIML 2.0 Draft//EN" "UIML2_0g.dtd">
<uiml>
 <interface id="myinterface">
   <structure>
     <part id="loan_Dialog1" class="JFrame">
       <style>
              <property name="title"  part-name="loan_Dialog1">Choose
              Scenarios</property>
              <property name="size" part-name="loan_Dialog1">300,109</property>
          <property name="layout">java.awt.BorderLayout</property>
          <property name="visible">false</property>
        </style>
          <part  id="loanD1Group1"  class="ButtonGroup">
                <part id="loanD1radio1"  class="JRadioButton">
                   <style>
                      <property name="bounds">25,25,188,25</property>
                      <property name= "text"> {cancelLoan,regularLoan} </property>
                     <property name="enabled">true</property>
                      <property name="borderAlignment" >North </property>
                   </style>
                </part>
               <part id="loanD1radio2"  class="JRadioButton">
                   <style>
                     <property name="bounds">25,50,125,25</property>
                     <property name="text">{errorUserLoan}</property>
                     <property name="enabled">true</property>
                     <property name="borderAlignment">Center</property>
                   </style>
             </part>
          </part>
  </part>
                                        •
                                        •
                                        •
                                        •
                                        •
                                        •
</structure>




<behavior>
        <rule>
                <condition>
                        <event class="actionPerformed" part-name="loanD1radio1"/>
                </condition>
                <action>
                        <property part-name="txtArea1" name="content">DISPLAY
                        </property>
                        <property part-name="txtArea1" name="content"> <property part-
                        name="L 2" name="text"/></property>
                        <property part-name="txtArea1" name="content"></property>
                        <property part-name="txtArea1" name="content">DISPLAY
                        </property>
                        <property part-name="txtArea1" name="content"> <property part-
                        name="L 3" name="text"/></property>
                        <property part-name="txtArea1" name="content"> </property>
                        <property part-name="txtArea1" name="content">DISPLAY
                        </property>
                        <property part-name="txtArea1" name="content"> <property part-
                        name="L 4" name="text"/></property>
                        <property part-name="txtArea1" name="content"> </property>
                        <property part-name="txtArea1" name="content">ENTER
                        </property>
                        <property part-name="txtArea1" name="content"> <property part-
                        name="L 5" name="text"/></property>
                        <property part-name="txtArea1" name="content"> </property>
                        <property part-name="txtFld5" name="enabled">true</property>
                        <property part-name="txtFld5" name="text"></property>
                        <property part-name="button2" name="enabled">true </property>
                        <property part-name="txtArea1" name="content">CLICK
                        BUTTON </property>
                        <property part-name="txtArea1" name="content">
                        <property part-name="button2" name="text"/></property>
                        <property part-name="txtArea1" name="content">
                        </property>

                        <property part-name="loan_Dialog1" name="visible">false
                        </property>
                </action>
        </rule>

                                        •
                                        •
                                        •
                                        •
                                        •
                                        •

   </behavior>
  </interface>
  <peers>
        <presentation source="Java_1.3_Harmonia_1.0.uiml#vocab"
                base="Java_1.3_Harmonia_1.0"/>
  </peers>
</uiml>
```

Appendix B: Snapshots of the UI prototype



ENTER enter_user_id
CLICK BUTTON confirm_id

(cancelLoan,registerLoan)
(printUserLoan)

enter_user_id	
display_user_name()	
display_user_address()	
display_user_telephone()	
enter_document_id	
display_document_title()	
display_document_authors()	
display_document_status()	
display_date_due()	

```
  </behavior>
</interface>
<peers>
  <presentation source="Java_1.3_Harmonia_1.0.uiml#vocab" base="Java_1.3_Harmonia_1.0"/>
</peers>
```

References

1. Project page : http://collab.dlib.vt.edu/runwiki/wiki.pl?IsRprojKelapureThree
2. Scenario synthesis algorithm 1: http://www.iro.umontreal.ca/labs/gelo/suip/GELO-82.pdf
3. Scenario synthesis algorithm 2: http://www.iro.umontreal.ca/~labgelo/Publications/Papers/ccpe-2001.pdf
4. Scenario synthesis algorithm 3: http://www.iro.umontreal.ca/labs/gelo/suip/bookChapter.pdf
5. The SUIP tool for scenario-based prototyping: http://www.iro.umontreal.ca/labs/gelo/suip/
6. UIML draft specification version 3.0 : http://www.uiml.org/specs/uiml3/DraftSpec.htm
7. UIML draft specification version 2.0 : http://www.uiml.org/specs/uiml2/DraftSpec.htm
8. List of java classes supported by the renderer: http://www.uiml.org/toolkits/Java_1.3_Harmonia_1.0.uiml