Software Engineering Lab

Institut d’Informatique
Faculté des Sciences, UMONS

<< Tom Mens
Romuald Deshayes >>
MPM Related Research

- **Model inconsistency management** - Detection and resolution of inconsistencies in software models
  - Using **graph transformation** (R. Van Der Straeten)
    - WADT 2007
  - Using **automated planning** (with J. Pinna Puissant)
    - ECMFA 2012
  - Using **description logics and model checking** (with R. Van Der Straeten)
    - ECMFA 2011
  - Using **logic programming** (with X. Blanc)
    - CAiSE 2009, ICSE 2008

![Diagram of model inconsistency management]

- **model** → **annotate model with detected inconsistencies** → **detect model inconsistencies** → **select inconsistencies to be repaired** → **choose appropriate repair rule** → **repair inconsistency** → modify model by selected inconsistency repair rules (may give rise to new inconsistencies)
MPM Related Research

- Model transformation (using graph transformation)
  - Model and program refactoring (with G. Taentzer)
    - STTT 2010
    - AGTIVE 2007, SOSYM 2007, GTTSE 2005
- Architectural restructuring (with D. Tamzalit)
  - ECBS 2010; IEEE Computer 2010
Non MPM research

• Empirical analysis of open source software ecosystems (with M. Goeminne, A. Serebrenik)
  • Technical aspects: Study software quality (code or design models) and complexity
  • Social aspects: study software community and their interaction, communication and collaboration
  • Study how software evolves over time
    • Increase or decrease in complexity, quality, size, productivity, popularity, ...

• Papers
  • IWSECO 2011, SQM 2011, CSMR 2011
  • ICSM 2008, OSS 2009, IWST 2009
Non MPM research

- Modeling of HMI applications
  - See presentation by Romuald Deshayes
  - Discrete modeling of user interaction + continuous modeling of physical interaction
Current research projects

ARC Project « Ecological Studies of Open Source Software Ecosystem »
- 2012-2016
- Applying theories of biological evolution and ecosystems to software evolution and ecosystems

ARC Project « Model-Driven Software Evolution »
- 2008-2012
- Focus on model quality improvement, model inconsistency management and model refactoring

FEDER Project « Centre d’Expertise en Ingénierie et Qualité des Systèmes »
- 2008-2013
- CETIC, CENA, FUNDP, Multitel, UCL, ULB, Umons

FRFC Project « Centre de Recherche en Adaptabilité Logicielle »
- 2009-2012
- In collaboration with K. Mens (UCL) and P. Heymans (FUNDP)
UI Modelling and Recognition of 3D virtual scenes and objects

Romuald Deshayes

Software Engineering Lab

Computer Science Institute
Table of Contents

1. About Me
2. Introduction
3. Gestural interaction
4. Proof-of-concept application
5. Modeling interactive behaviour
6. Statecharts
7. Work in progress
8. Conclusion
About Me?

- Romuald Deshayes
- 23 Years old ↔ 1st Year PhD
- Belgium: University of Mons, Software Engineering Lab.
About Me ? - continued

Interests

- Work in UI Modelling
- More specifically in Gestural interactions
- Modelling the interactions with virtual objects
  - Physical (continuous) interactions
  - Command/Action-type (discrete) interactions triggered by gestures
Introduction

- Different objects with different ways of interacting with them
Introduction

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Introduction

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Introduction

- Different objects with different ways of interacting with them
- Enhance computer with better insight in...
Introduction

- Different objects with different ways of interacting with them

- Enhance computer with better insight in
  - user interactions with virtual objects
Introduction

- Different objects with different ways of interacting with them

- Enhance computer with better insight in
  - user interactions with virtual objects
  - objects recognition
Introduction

- Different objects with different ways of interacting with them

- Enhance computer with better insight in
  - user interactions with virtual objects
  - objects recognition

[Target Domain] Virtual and Augmented Reality applications such as simulation, home automation and gaming
Goal of the project

Two main scientific contributions:

1) Generic solution to specify and execute interactions with virtual objects in an immersive way (Modelling)
2) Improve the robustness of 3D recognition algorithms, using 3D sensors

Combining those two ideas would allow various applications in many domains such as virtual reality, video games or home automation (domotics)
Goal of the project

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Gestural interaction
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Interacting with virtual objects in an immersive way?

- Gestural interaction
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Interacting with virtual objects in an immersive way?

- Gestural interaction
- VR glasses
Gestural interaction

Interacting with virtual objects in an immersive way?

- Gestural interaction
- VR glasses
- Tactile interaction
Gestural interaction

Interacting with virtual objects in an immersive way?

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Gestural interaction

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Gestural Interaction: using the body to communicate with the computer
Kinect

New generation of 3D sensors, equipped with:

- Normal color Camera
- Infrared Camera
- Infrared projector

→ RGB-D terminology is used, because this device is able to generate a 3D map of the observed scene (in real time)
Kinect

Kinect allows to

- segment a scene
Kinect

Kinect allows to:

- segment a scene
- detect a user and track him in real time (30hz)
Kinect allows to:

- segment a scene
- detect a user and track him in real time (30hz)
- basis for interaction with virtual objects
Kinect

Kinect allows to:
- segment a scene
- detect a user and track him in real time (30hz)
- basis for interaction with virtual objects

→ Better than 2D tracking
3rd dimension can be exploited to ease the segmentation and therefore the tracking.
Modeling interactive behaviour
Modeling interactive behaviour

Context

- Highly reactive systems (instantly react to user’s stimuli)
Modeling interactive behaviour

Context

- Highly reactive systems (instantly react to user’s stimuli)
- Gesture-based interaction
Modeling interactive behaviour

Context

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Modeling interactive behaviour

**Context**
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- Gesture-based interaction

**Visual language**
- Higher level than code
UI Modelling and Recognition of 3D virtual scenes and objects

Modeling interactive behaviour

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Visual language

- Higher level than code
- Simple for non developers
Modeling interactive behaviour

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- Highly reactive systems (instantly react to user’s stimuli)
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Visual language
- Higher level than code
- Simple for non developers
- Easier to evolve
Modeling interactive behaviour

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Visual language

- Higher level than code
- Simple for non developers
- Easier to evolve
- Reduced complexity
UI Modelling and Recognition of 3D virtual scenes and objects

Modeling interactive behaviour

**Context**

- Highly reactive systems (instantly react to user’s stimuli)
- Gesture-based interaction

**Visual language**

- Higher level than code
- Simple for non developers
- Easier to evolve
- Reduced complexity
- Amenable to formal analysis
Proof-of-concept application
Proof-of-concept application

- 3D visual drawing tool
Proof-of-concept application

- 3D visual drawing tool
- Uses gestures to create and manipulate 3D objects
Proof-of-concept application

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- Uses gestures to create and manipulate 3D objects
- Uses Kinect
Proof-of-concept application

- 3D visual drawing tool
- Uses gestures to create and manipulate 3D objects
- Uses Kinect
- (Part of Master thesis)
Example of statechart for modelling the behaviour of the hand in a gestural application
Work in progress
Work in progress

Actual work: Virtual library

- Book shelf filled with books
Work in progress

Actual work: Virtual library

- Book shelf filled with books
- Choose a book with hands
UI Modelling and Recognition of 3D virtual scenes and objects

Work in progress

Actual work: Virtual library
- Book shelf filled with books
- Choose a book with hands
- Read it with realistic gestures
Conclusion
Conclusion

- Work on 3D objects
Conclusion

- Work on 3D objects
  - Behaviour
Conclusion

- Work on 3D objects
  - Behaviour
  - Recognition
Conclusion

- Work on 3D objects
  - Behaviour
  - Recognition
- Various applications in many domains
Conclusion

- Work on 3D objects
  - Behaviour
  - Recognition
- Various applications in many domains
  - Augmented Reality
Conclusion

- Work on 3D objects
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- Various applications in many domains
  - Augmented Reality
  - Domotics
Conclusion

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  - Games
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- Work on 3D objects
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- Various applications in many domains
  - Augmented Reality
  - Domotics
  - Games
  - Animation movies
Conclusion

- Work on 3D objects
  - Behaviour
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- Various applications in many domains
  - Augmented Reality
  - Domotics
  - Games
  - Animation movies
  - ...

Where the smurf are we?

The Smurfs
In 3D
Summer 2011
Thank you for your attention!

Questions?