ARTALET: TANGIBLE USER INTERFACE BASED IMMERSIVE AUGMENTED REALITY AUTHORING TOOL FOR DIGILOG BOOK

2010 International Symposium on Ubiquitous Virtual Reality
INTRODUCTION

- Digilog Book
  - consists of a conventional printed book
  - multimedia contents

- AR authoring tools
  - programming based authoring tools
  - non-programming based authoring tools

- Artalet
  - AR [augmented reality]
  - Tale [story]
  - Let [booklet]
ARTELET: DIGILOG BOOK AUTHORING TOOL

**Input image**
- Tracking
  - Book
  - Menu prop
  - Manipulation prop
- Preview (Save: XML)

**User input**
- Tracking
  - 3D objects
- Selection
  - Authoring menu
- ARtalet (AR Authoring tool)
  - 3D bounding box

**Viewer (Display device, speaker, vibrator)**
- Authoring
  - Position/rotation, Scale/color, Insert/copy/delete
  - Trajectory manipulation, Mesh deformation
  - Audio/Haptic authoring
Manipulation prop

- A cubical box attachable to a mouse input device and with multiple markers printed on the box
Trajectory manipulation

- Adopted the Catmull-Rom spline model
Mesh deformation

- Fast lattice shape matching (FastLSM)
- Free form deformation (FFD)
Multi-sensory Authoring Functions (1/2)

- Vibro-tactile
  - Used to enhance immersion when authoring and reading the Digilog Book
  - Manipulation prop
    - Vibration actuator
    - Bluetooth communication module for wireless communication
    - Microcontroller for tactile feedback signal
    - Wireless communication process
Multi-sensory Authoring Functions (2/2)

- The 3D objects visually present multisensory feedback
  - visual (e.g., 3D object)
  - audio (e.g., sound effect)
  - haptic (e.g., vibration pattern)
IMPLEMENTATION

- **Running Environment**
  - In a normal indoor environment with no dramatic lighting changes
  - Camera used was a general purpose USB camera
  - Computer was equipped with a 2.40GHz CPU and 4GB memory
  - OsgART library
  - Commercial pen mouse
Results

- **Experiments**
  - To test the effect of audio and vibration feedback on 3D object manipulation

- **Participants**
  - Total of 20, 16 had previous experience in AR
  - Average age of 30

- **Task**
  - Composed of random 16 step trials of total 48 trials

<table>
<thead>
<tr>
<th>TABLE I. USER SUBJECTIVE RATINGS USING LIKERT SCALES (0 ~ 6 SCORE; 0 BEING MOST NEGATIVE AND 6 BEING MOST POSITIVE)</th>
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<tbody>
<tr>
<td><strong>Depth perception</strong></td>
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<tr>
<td>Audio feedback</td>
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<td>Vibration feedback</td>
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DEMO

- http://www.youtube.com/watch?v=pLciqISv0ec
Several problems remain unsolved

- Additional equipment
  - Smartphone device
- Computer vision tracking error
  - Difficult to extract good features and proper tracking for similar patterns (e.g., text majority), dark figures, and reflective material

- Requiring more diverse information
- Simplifying the authoring process
CONCLUSION

- Additional trajectory insert technique
- 3D object deformation and real-time optimization
- An improved pen-type haptic device and a method
Thank You For Listening