Falcon City: An Integration of Novint Falcon in Virtual Reality
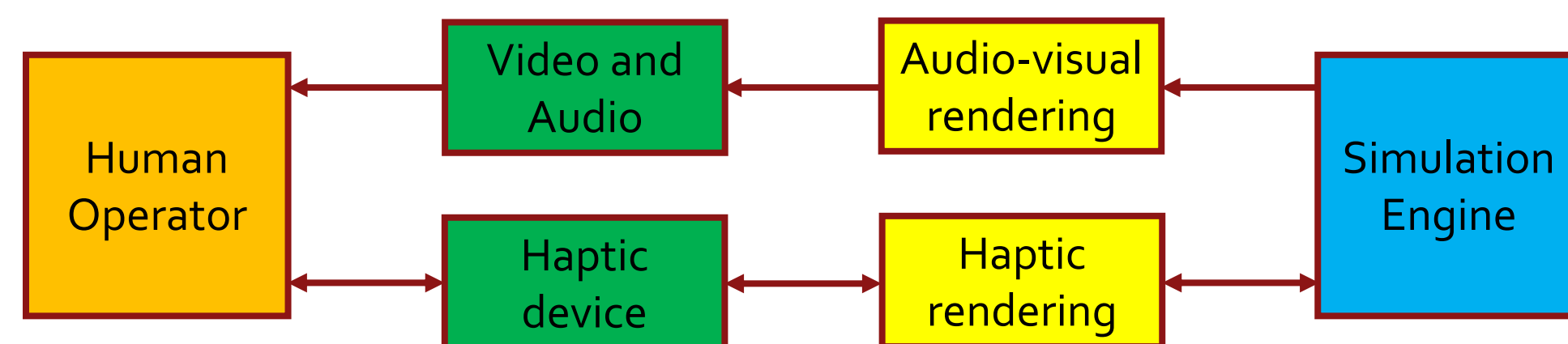
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Haptic Devices and Novint Falcon

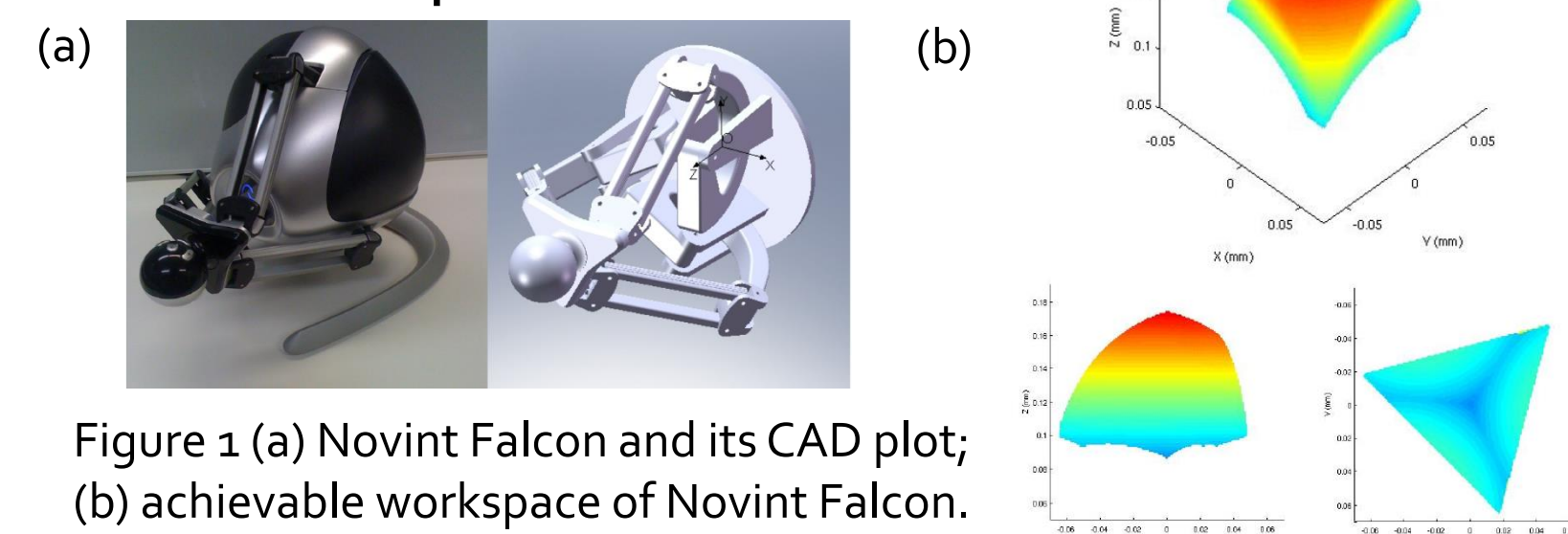- **Benefits of Haptic Devices**
  Allowing users to "feel" virtual objects in simulated environment

- **Rendering Flow with Haptic Devices**

- **Novint Falcon**
  With 3 degree of freedom, using USB interface with 1kHz update rate

(a)   (b)

Figure 1 (a) Novint Falcon and its CAD plot; (b) achievable workspace of Novint Falcon.

Other Haptic Devices

Phantom Omni
Allowing user to manipulate virtual objects with 6-DOF

Dexmo F2
Experiencing sensation of picking up objects in any virtual content

Gloveone
Feeling and interacting with any object or environment in VR

KOR-FX
Gaming vest worn by user and giving acoustic feedback in VR

Preparation of Effects and Scenes

- **Demonstration Target**
  Manipulating different objects with different texture effects to improve VR experience

- **Capability of Novint Falcon SDK**
  - Obtaining current position
  - Obtaining information on whether a button is pushed down
  - Setting target position and/or target force

- **Choice of Theme: SimCity**
  - Providing a context to interact with different materials (features)
  - Integrating special effects with the buttons, e.g. popping a building
  - Other theme options: operation/dissection, cooking etc.

Implementation and Results

- **Implementation of different effects**

Solid surface
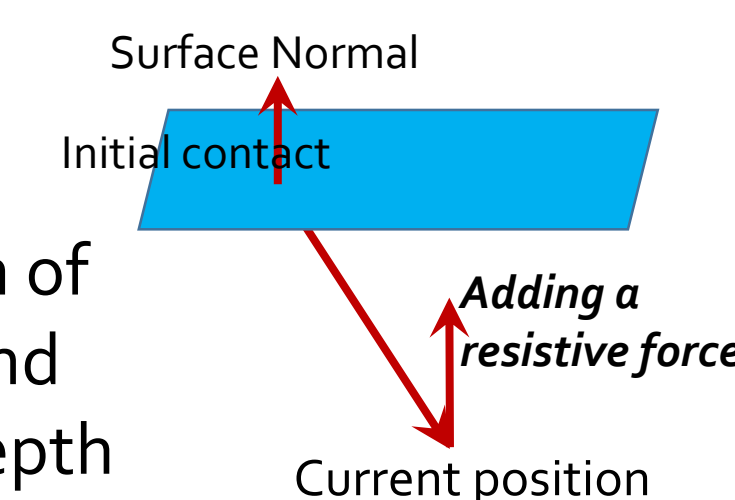- Feedback to push Falcon-controlled object back to contact surface

Surface Normal
Initial contact
Feedback target position
Current position
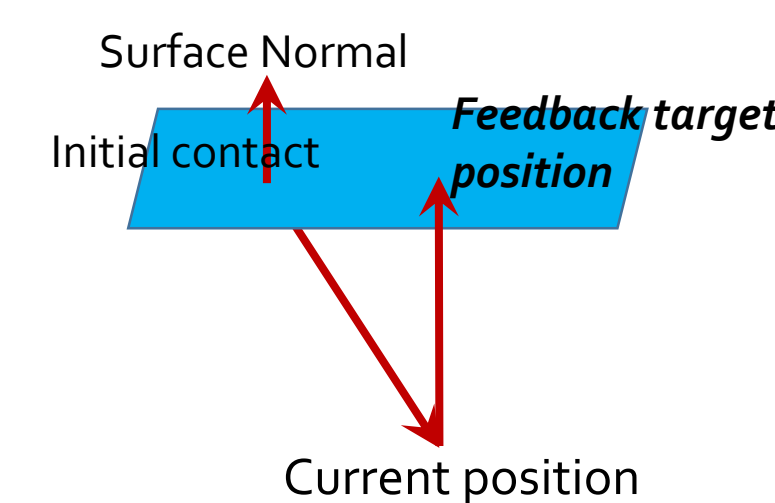
Sand
- Feedback to add a random force to emulate the sliding and roughness surface

Surface Normal
Initial contact
Current position
Random force added to emulate contacting sand
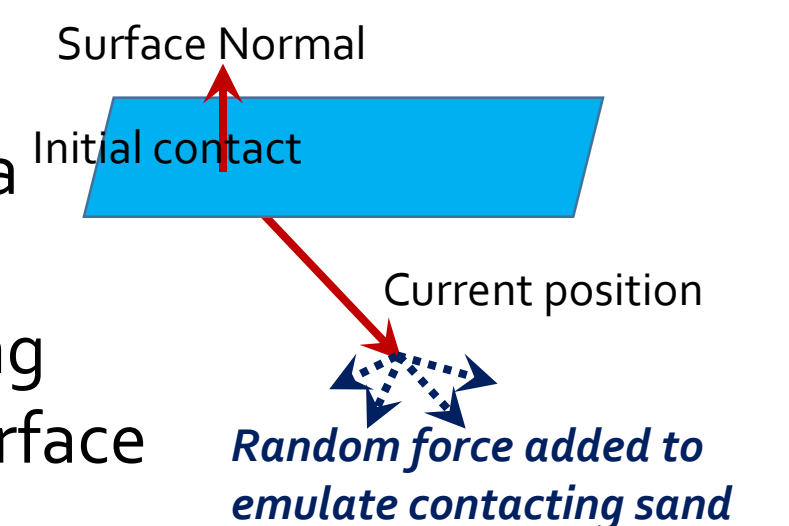
Water
- To give a force in opposite direction of surface normal, and proportional to depth

Surface Normal
Initial contact
Adding a resistive force
Current position

Pop
- If "Pop" button activated, transforming the contacting object with Falcon position
- Adding an opposite force when movement distance is below threshold value

- **Scene Screenshots**
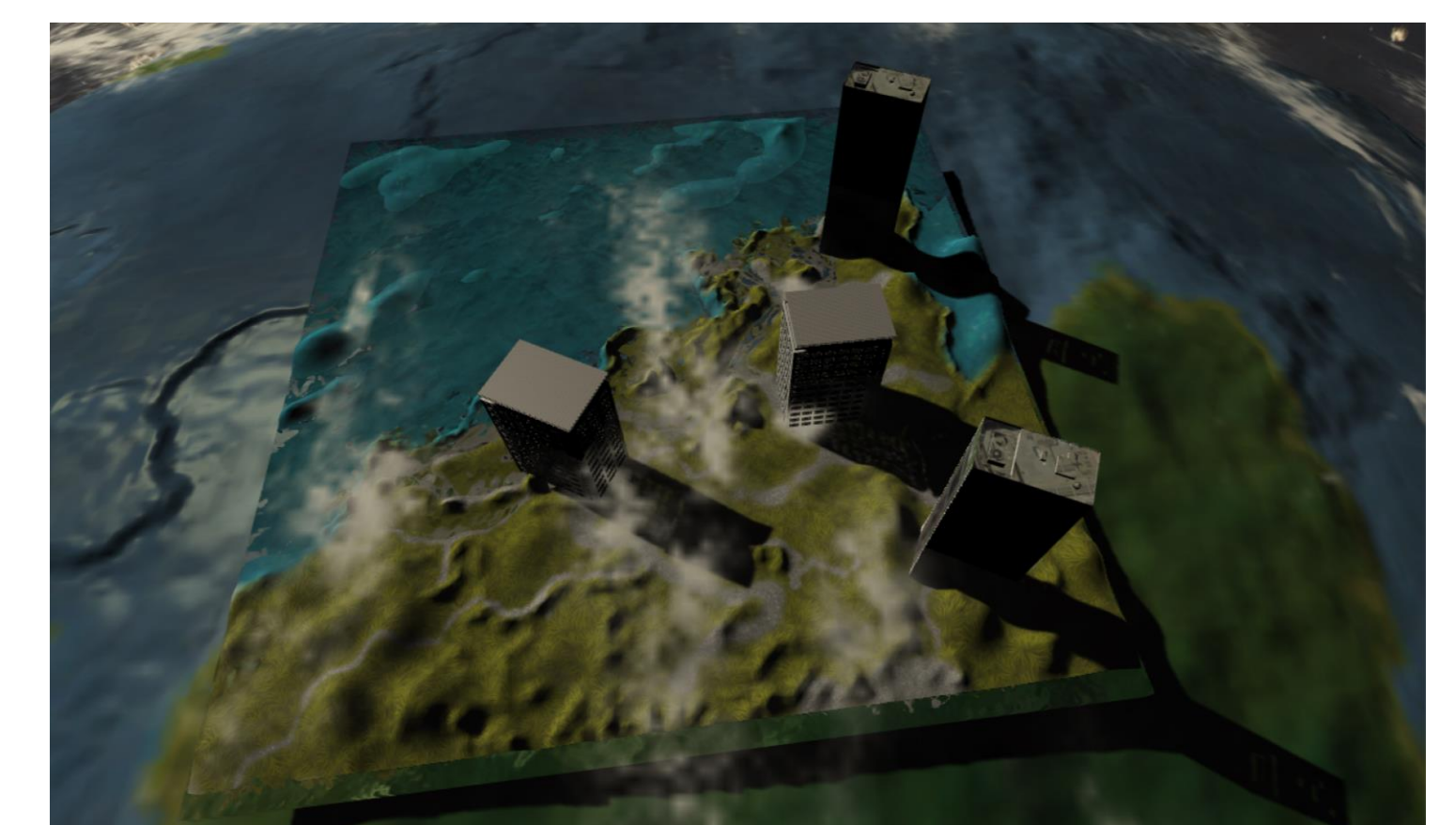
References

[1] K. Salisbury, F. Conti, and F. Babagli, "Haptic Rendering: Introductory Concepts," *IEEE Computer Graphics and Applications*, vol. 24, no. 2, pp. 24-32, 2004.
[2] S. Martin and N. Hillier, "Characterisation of the Novint Falcon Haptic Device for Application as a Robot Manipulator, " in Australasian Conference on Robotics and Automation (ACRA), pp. 1-9, 2009.
[3] E. Ruffaldi, A. Frisoli, M. Bergamasco, C. Gottlieb, and F. Tecchia, "A Haptic Toolkit for the Development of Immersive and Web-Enabled Games, " in VRST '06, pp. 320-324, 2006.

Acknowledgement