Introduction to Augmented Reality

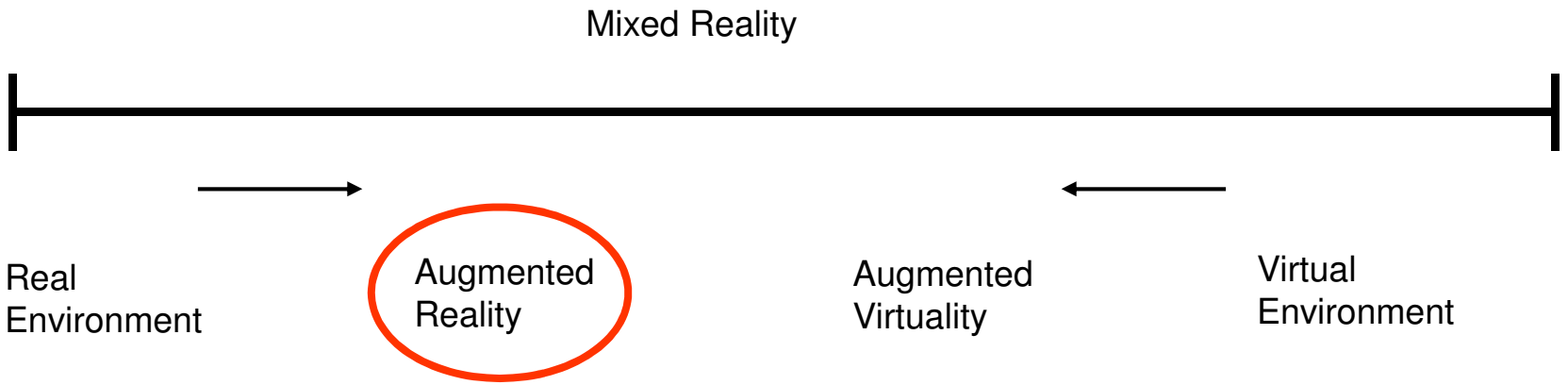
Definition

- Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data.

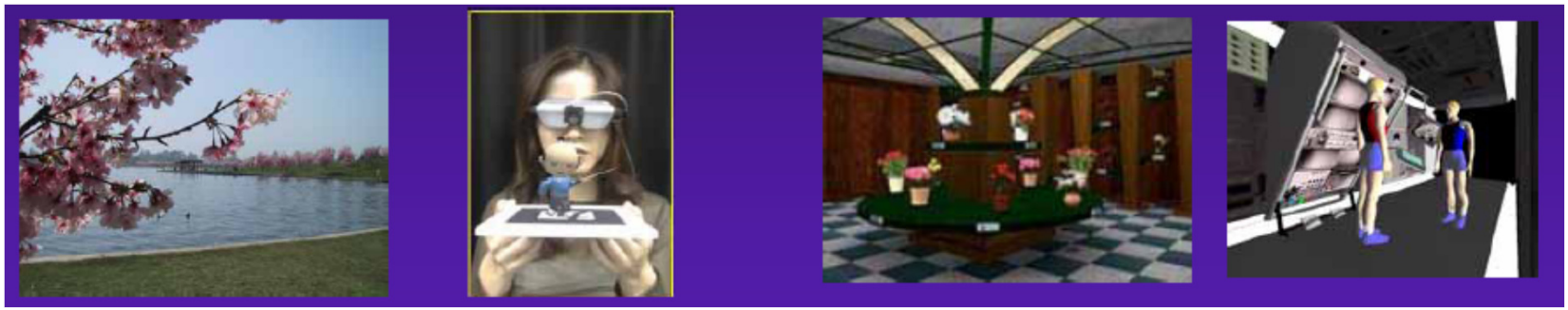
iPhone using the Wikitude application, demonstrating an example of Augmented Reality

Reality v.s. Virtuality

- Milgram's Reality-Virtuality Continuum



Milgram and Kishino



Billinghurst

Augmented reality v.s. Virtual reality

- Virtual Reality: Replaces Reality
  - Immersive Displays

5DT HMD 800

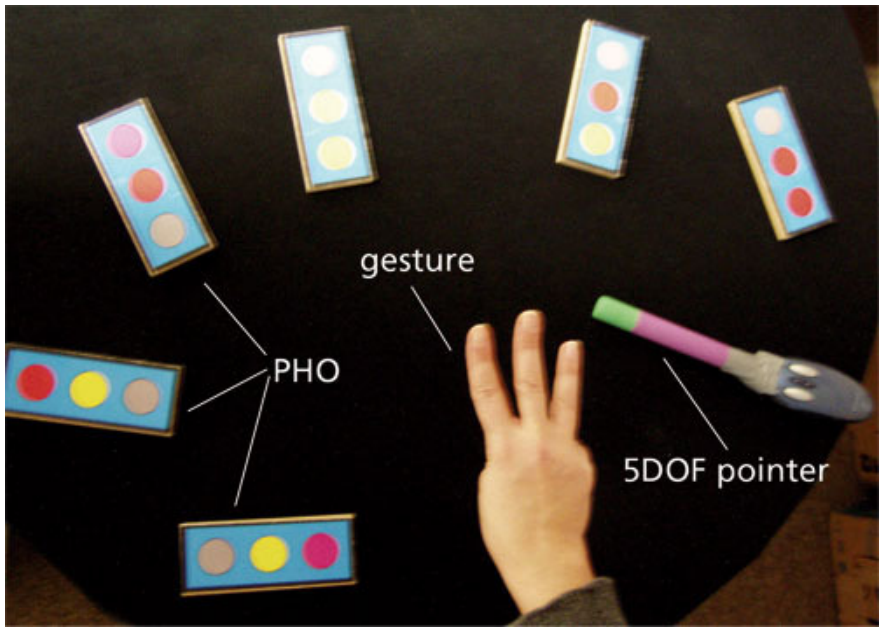
Virtual Viewer 3D

SIM EYE SR100-A

Augmented reality v.s. Virtual reality

- Augmented Reality: Enhances Reality
  - See-through Displays

ARTHUR See-through head mounted display (HMD)



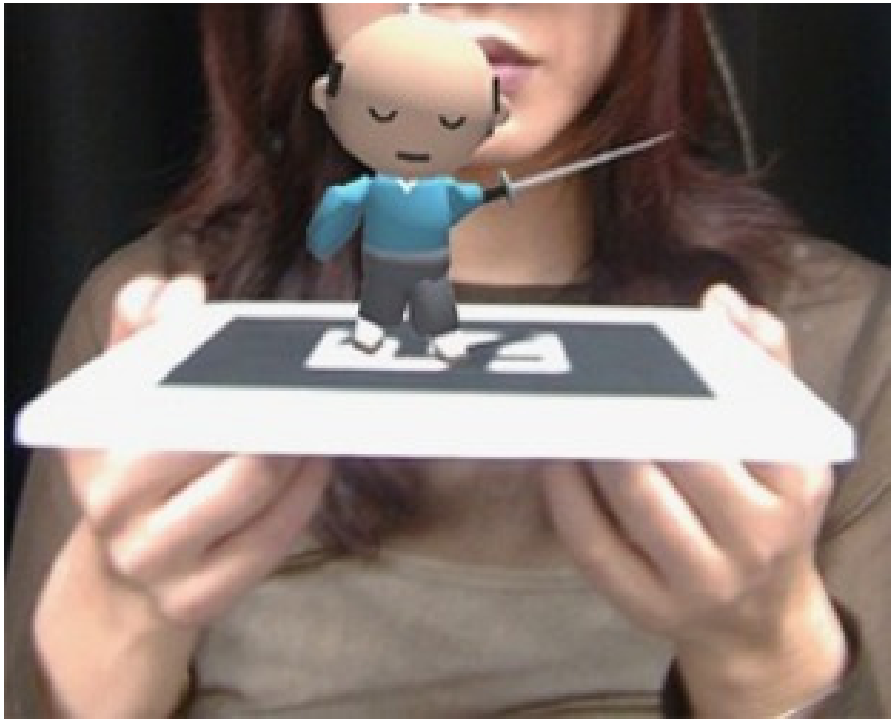
Input image for CV-based recognition of PHOs, pointers, and finger gestures.

ARTHUR: A Collaborative Augmented Environment for Architectural Design and Urban Planning

Augmented reality v.s. Virtual reality

Two users collaborating at the augmented round table

Augmented reality v.s. Virtual reality



VR Pro AR (Augmented Reality) head mounted display has one color, SVGA, USB camera and one VGA input.

Augmented reality

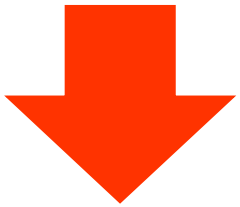
- Characteristics
  - Combines Real and Virtual Images
  - Interactive in real-time
  - Registered in 3D

Lecture material from M. Cooper

Goal of AR

- Enhance human performance and perception of the world

Ultimately!

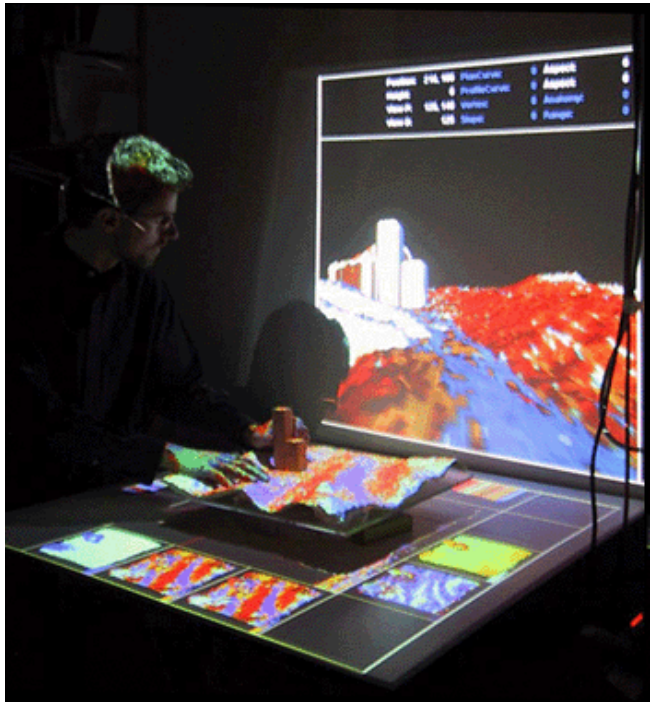


- Create a system such that the user CANNOT tell the difference between the real world and the virtual augmentation of it

Tangible Interfaces

- Tangible Interfaces (Ishii 97)
  - a user interface in which a person interacts with digital information through the physical environment. (wiki)
  - Create digital shadows for physical objects

    http://www.youtube.com/watch?v=0h-RhyopUmc



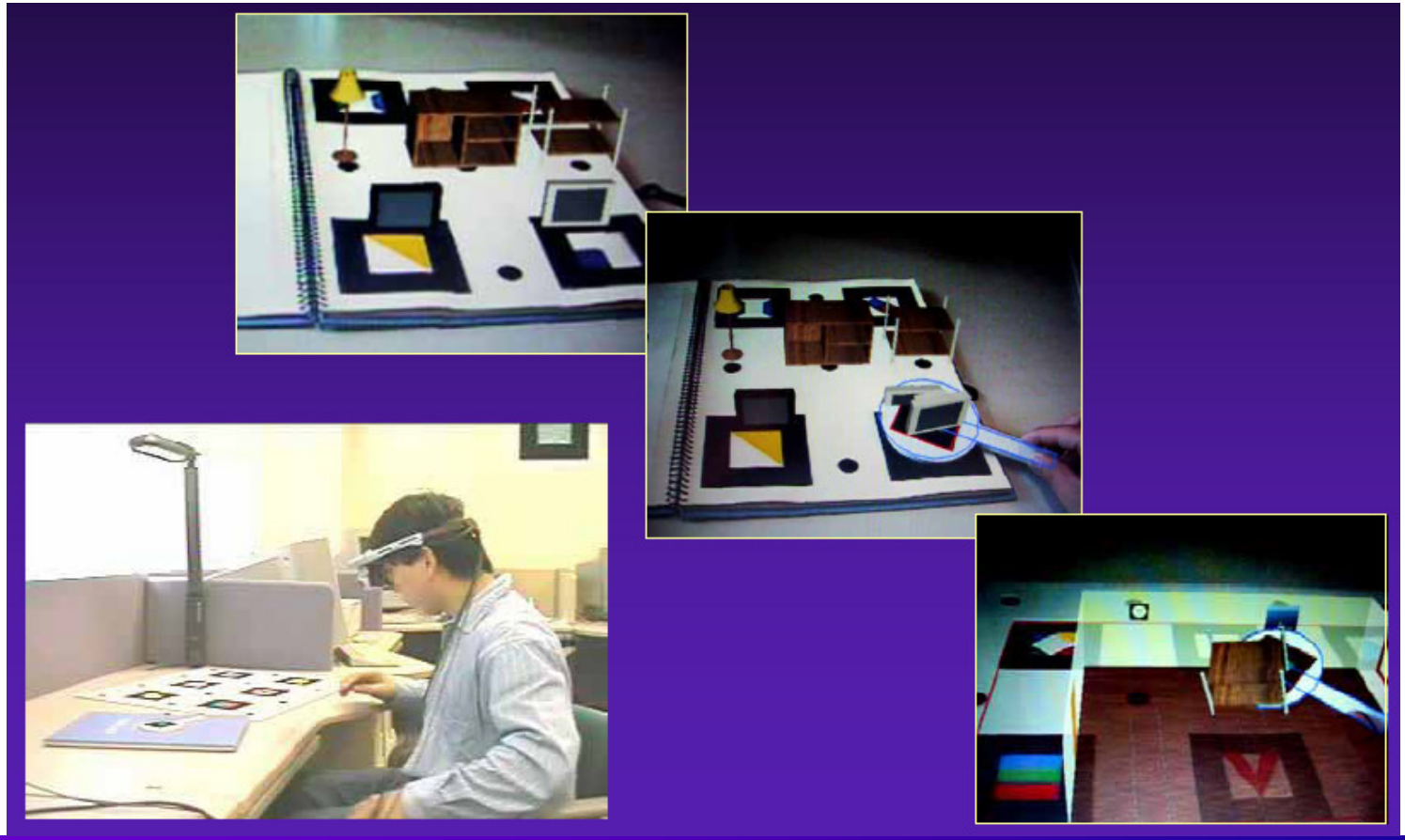
Tangible Augmented Reality

Tangible Augmented Reality is a design concept that integrates TUI and AR.

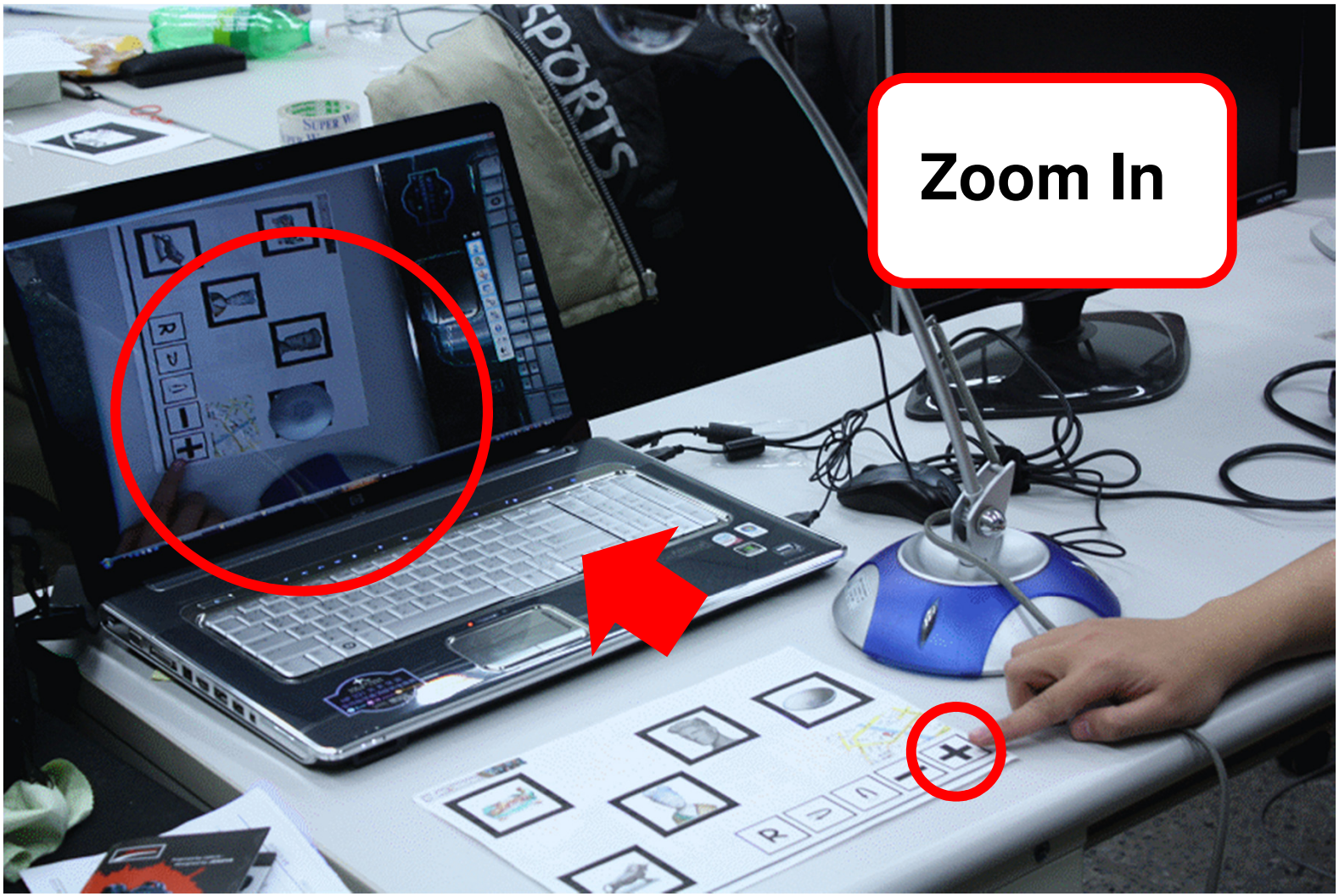
- Virtual objects are seamlessly coupled to physical world.
- Physical object affordances are used for the interaction.
- The form of objects encourages spatial manipulation.
- Multi-handed and multi user interactions are possible.

Tangible AR Interaction Techniques

- Use of natural physical object
  - manipulations to control virtual objects

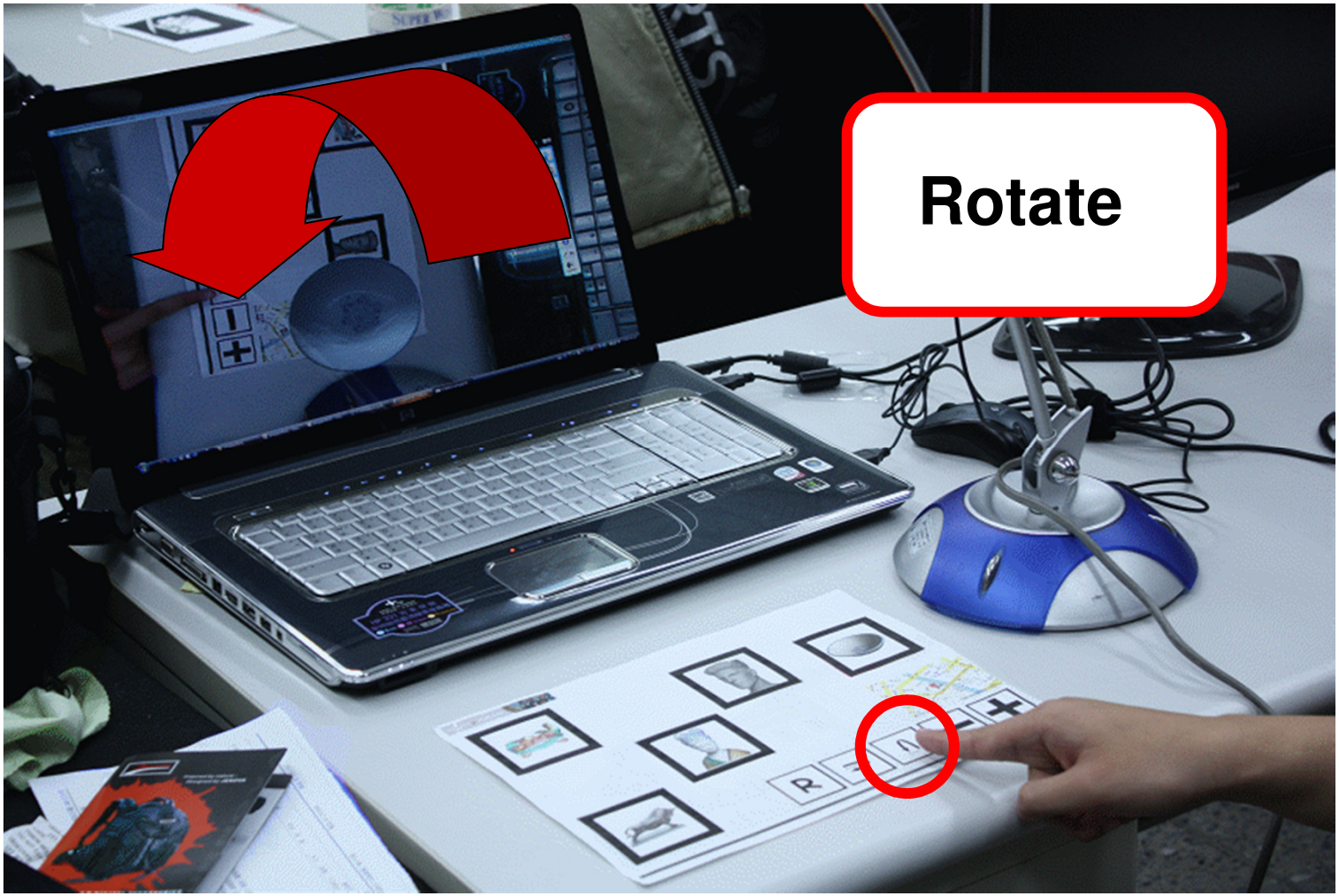


Simple AR setup – camera and monitor



User selects the zoom in function to increase the size of the displayed 3D model.

Simple AR setup – camera and monitor



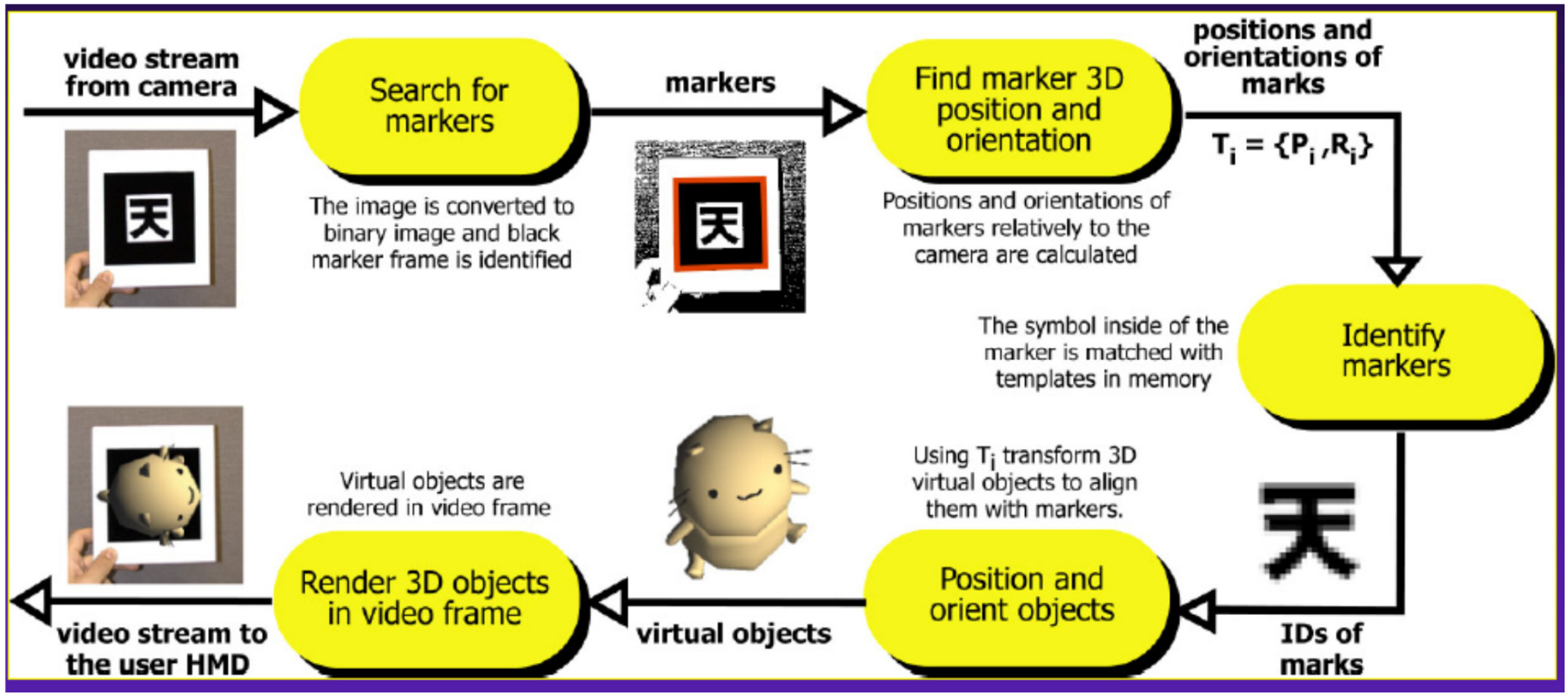
User uses the rotation marker to rotate the 3D object.

ARToolKit

- Computer vision tracking library that allows for the creation of augmented reality applications that overlay virtual imagery on the real world
- Has video tracking capabilities to calculate the real camera position and orientation relative to markers in real time
- developed by Hirokazu Kato in 1999
- one of the most widely used AR tracking libraries with over 160,000 downloads since 2004

ARToolKit

- Computer vision based tracking libraries



ARToolKit

Features

- Single camera position/orientation tracking.
- Tracking code that uses simple black squares.
- The ability to use any square marker patterns.
- Easy camera calibration code.
- Fast enough for real time AR applications.
- Free and open source

- Can be downloaded from Sourceforge
  http://sourceforge.net/projects/artoolkit/files/
  ARToolKit-2.72.1-bin-win32.zip
  OpenVRML-0.14.3-win32.zip
  DSVL-0.0.8b.zip

ARToolKit

- Setting up

  http://www.hitl.washington.edu/artoolkit/documentation/usersetup.htm

Try AR on your mobile device

AR Browser – Junaio

- Website: http://www.junaio.com/
- Download: http://www.junaio.com/download/
- Demos: http://www.metaio.com/fileadmin/upload/documents/promo_book/ARDemoBooklet-2013-digital_vers.pdf