# Real-World Interaction using Various Sensors
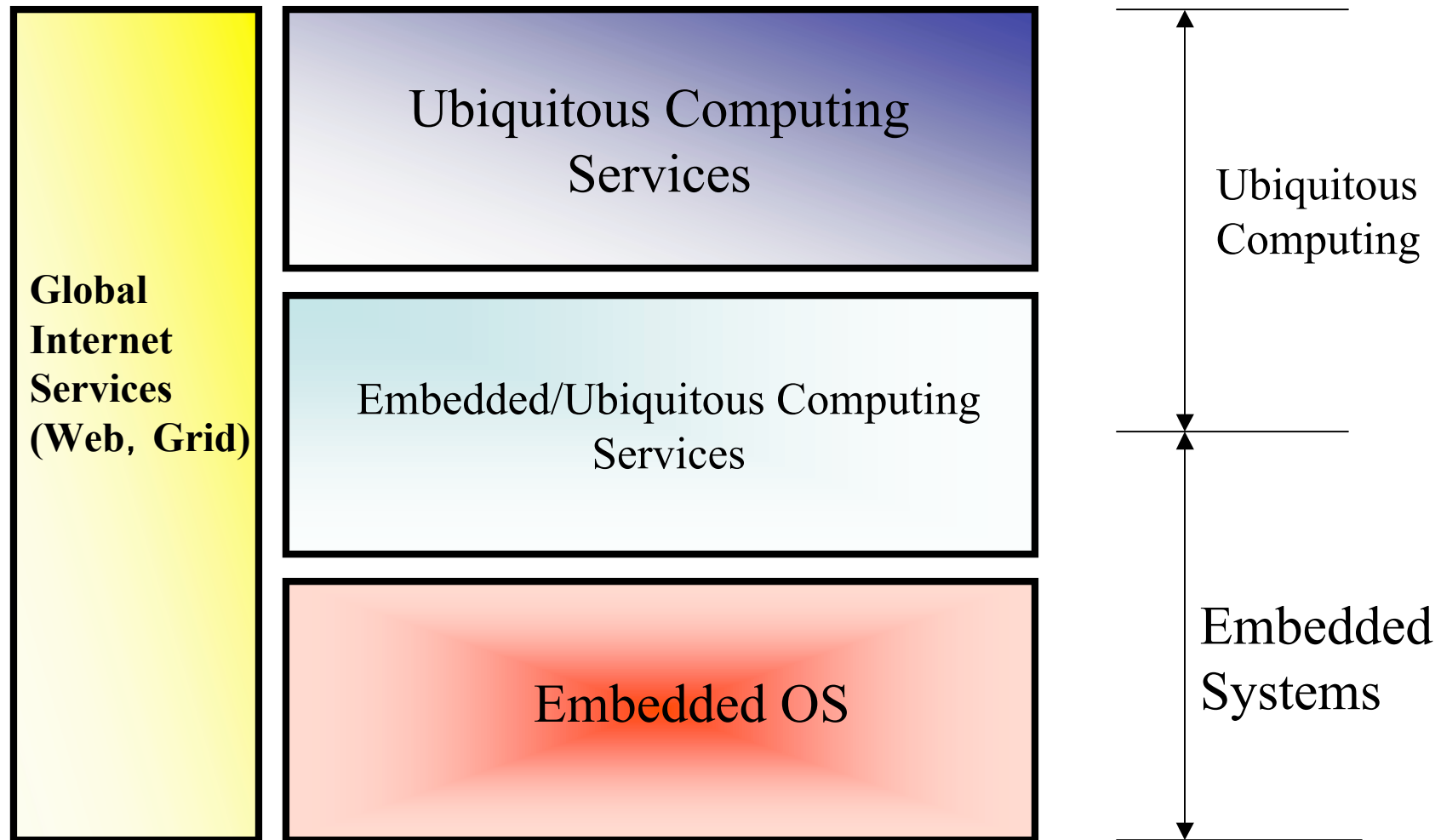
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# Overview of Our Research Map

**Global Internet Services (Web, Grid)**

Ubiquitous Computing Services

Embedded/Ubiquitous Computing Services

Embedded OS

Ubiquitous Computing

Embedded Systems

Embedded Systems: Cooperating with embedded system industries
Ubiquitous Computing: Cooperating with research communities

# *Distributed and Ubiquitous Computing Lab.*

- **Operating Systems**
  - Microkernel, Embedded OS

- **Middleware**
  - CORBA, HAVi, UPnP/DLNA, OSGi, Personal Coordination Server

- **Augmented Reality/Interaction**
  - MIRAGE, Vidgets, Cookie Flavor, Lifestyle Gaming

- **Sensor-based Systems**
  - Sentient Artefatcs, Ambient/Augmented Display

# Our Research Motivation

- Virtualizing Artefacts
  - Things sense their surrounding and changes them according to their situation.
  - This is a future embedded systems.

- Objectifying Services
  - Visualize embedded services in our environments and control them in a natural way.
  - This is a future Internet service.

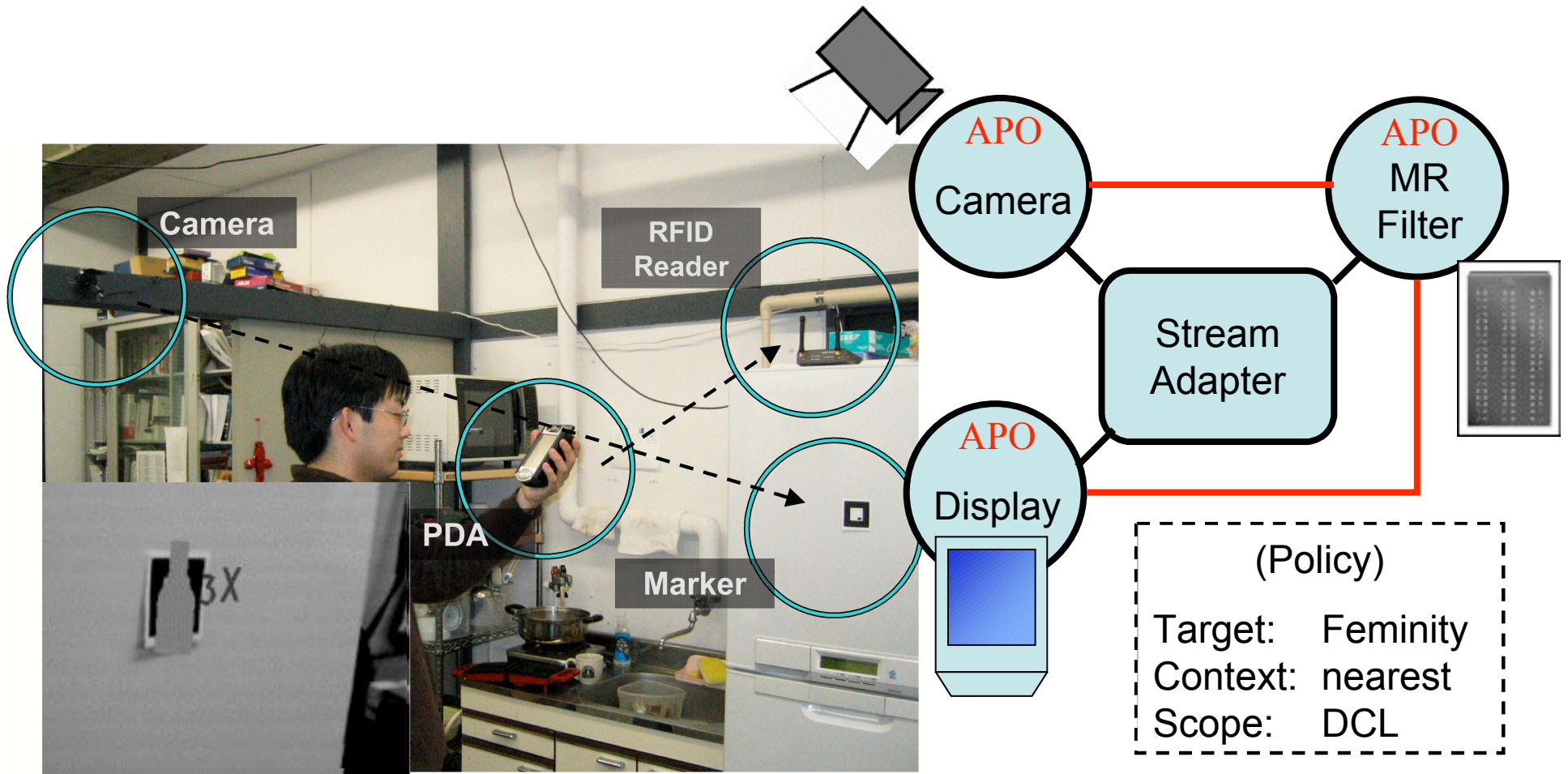- The above two approach integrates virtual and real.

# Future Interaction Techniques

- We need a variety of ways to interact to the real world.

- Tangible interface is important to access various services embedded in our daily life.

- Information and service model is used to be accessed by manipulating physical objects in a systematic way.

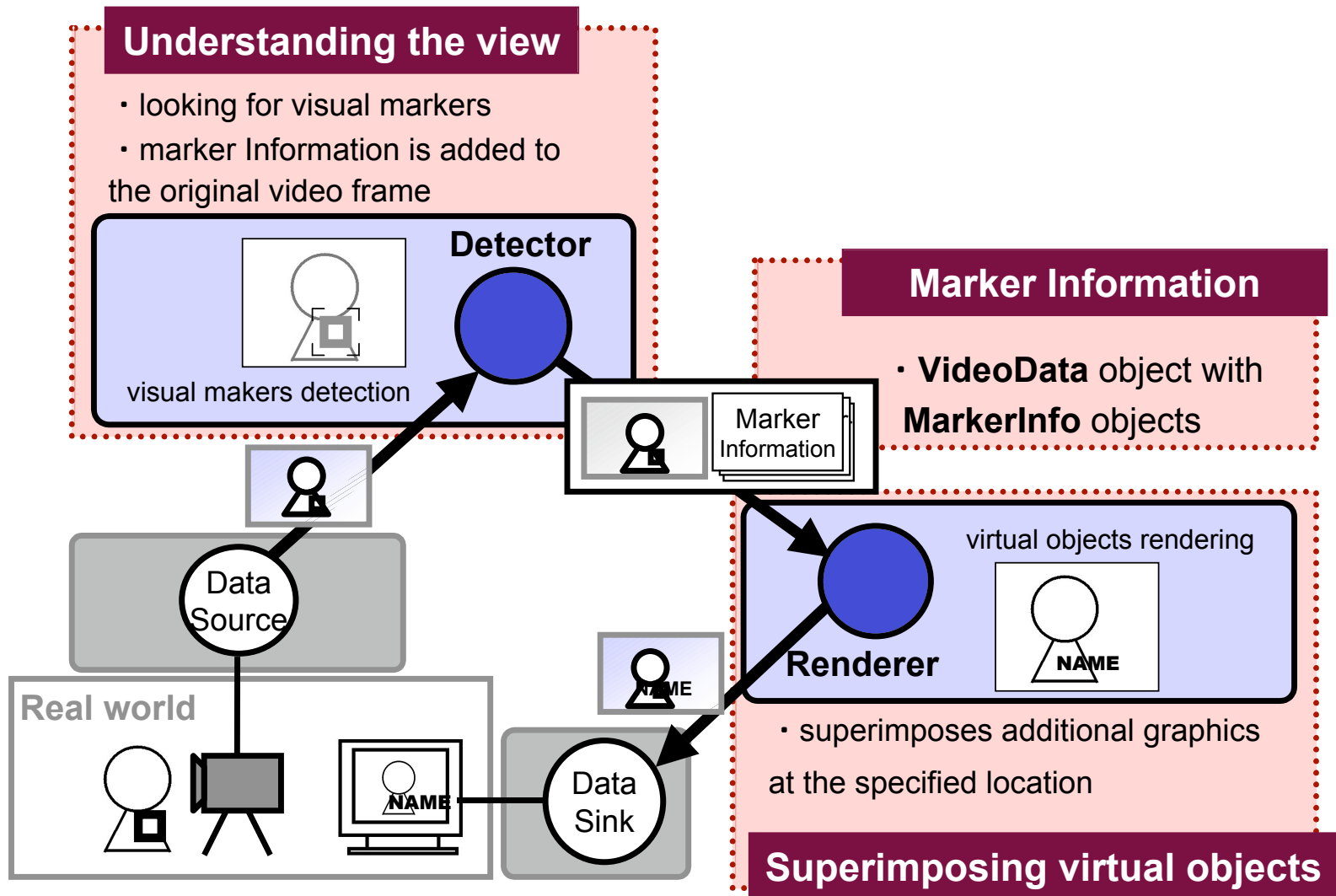- Sensors are useful to enhance the current interaction techniques.

# Identification Techniques

- Identifying Real Objects
  - Real world interaction requires to know what and where is this object.
  - RF tags and visual tags are widely used to identify objects.
- Identifying Services
  - Various services are embedded in our environments and appliances.
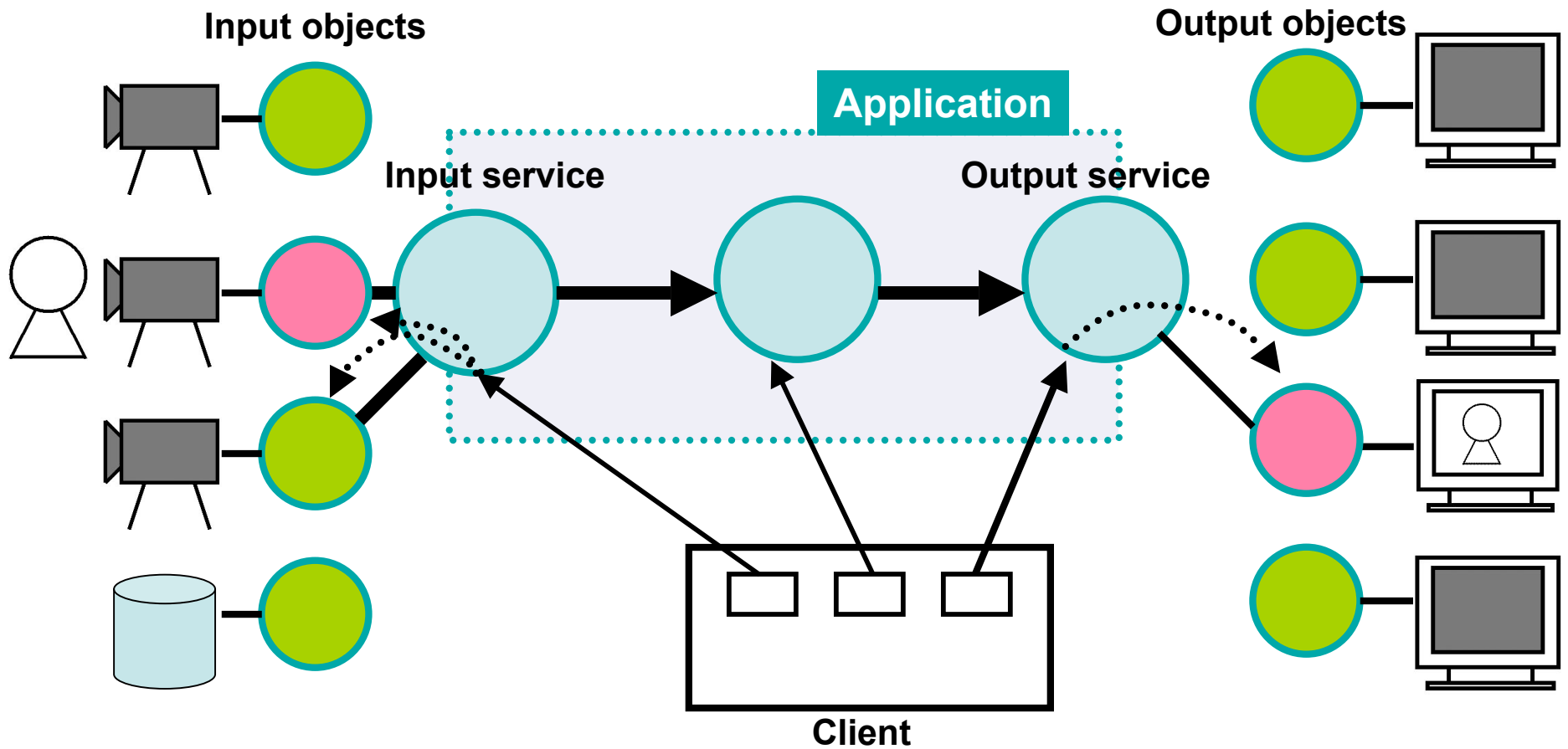  - We need to find services that are useful in the current situation.

# MiRAGe: Mixed Reality Applications Generator for Mobile Mixed Reality



IEEE Mobiquitous 2004

# Component-based Multimedia Framework

**Understanding the view**

- looking for visual markers
- marker Information is added to the original video frame

**Detector**

visual makers detection

**Marker Information**

Marker Information

- **VideoData** object with **MarkerInfo** objects

virtual objects rendering

NAME

**Renderer**

- superimposes additional graphics at the specified location

**Superimposing virtual objects**

Data Source

Data Sink

NAME

**Real world**

NAME

# Dynamic Configuration of Multimedia Components

# Integrating Existing Toolkits

- ## ARToolkit
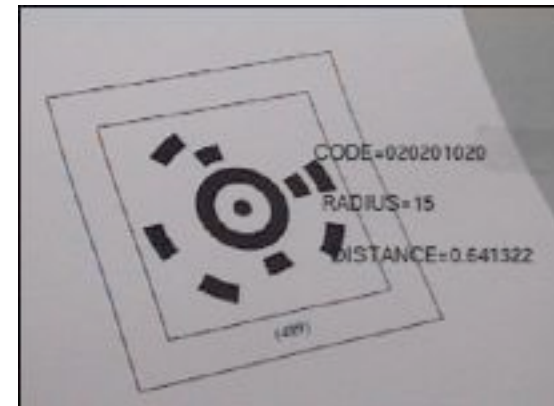  (HIT Lab. University of Washington)
  - A marker detection algorithm
  - marker information data type
  - Superimposed virtual objects mechanism
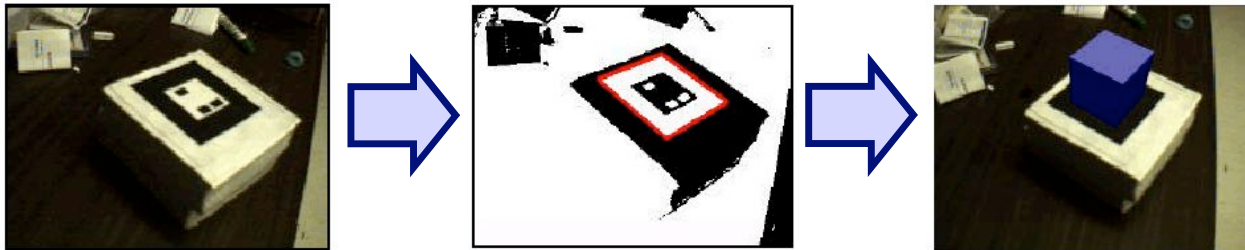


- ## Trip
  (Sentient Computing Lab. University of Cambridge)
  - A marker detection algorithm

# *Vidgets Interaction Framework*

- There will be many services embedded in our surroundings.

- Superimposing the real world is a simple way to show embedded services to users.

- Fluid transition of service discovery, selection, and control by using a personal device.

- Service discovery using visual tags.
  - A user finds a suitable service through his eye.

- Selecting a service by holding a grip of the personal device.
  - Downloading a mobile code for controlling user interface.

- Controlling the service by using sensors and audio feedback.
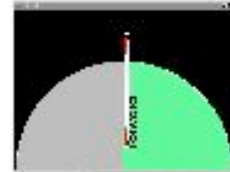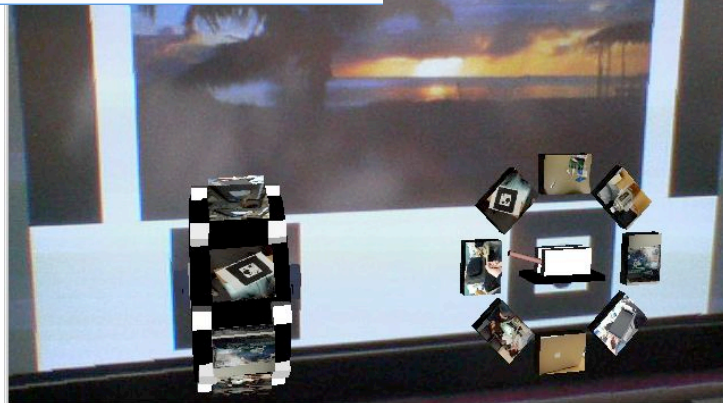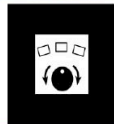  - When releasing a grip, backing to a searching mode.

ACM ICMI 2006

# *Vidgets Stage Transition*
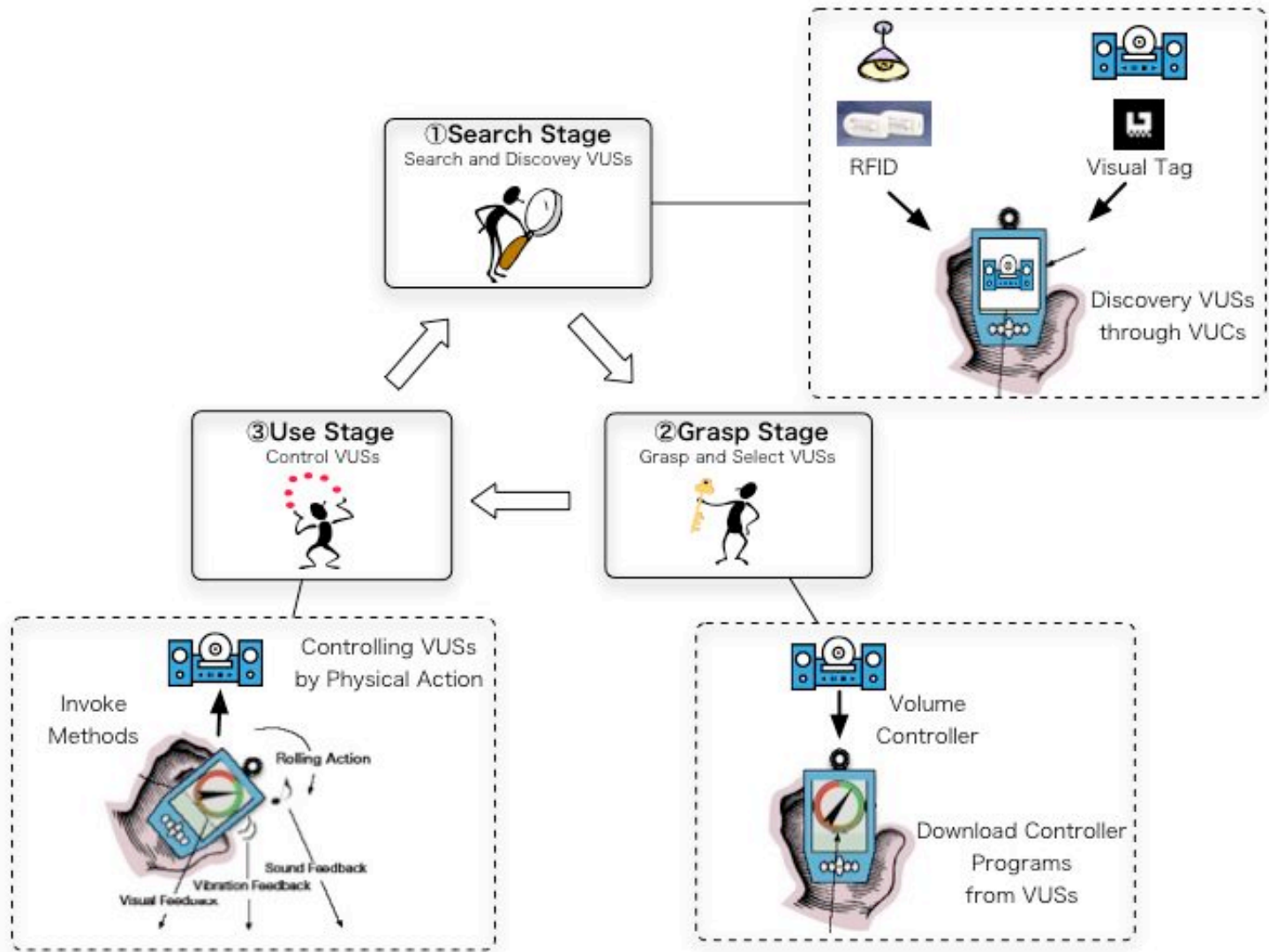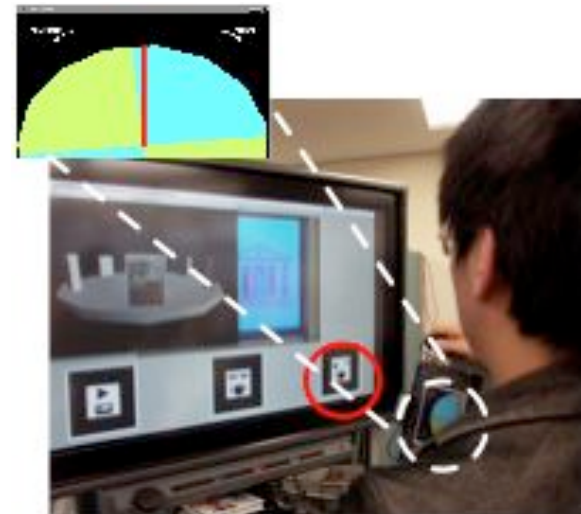
# *Vidgets Mobile Terminal*



Front

Back
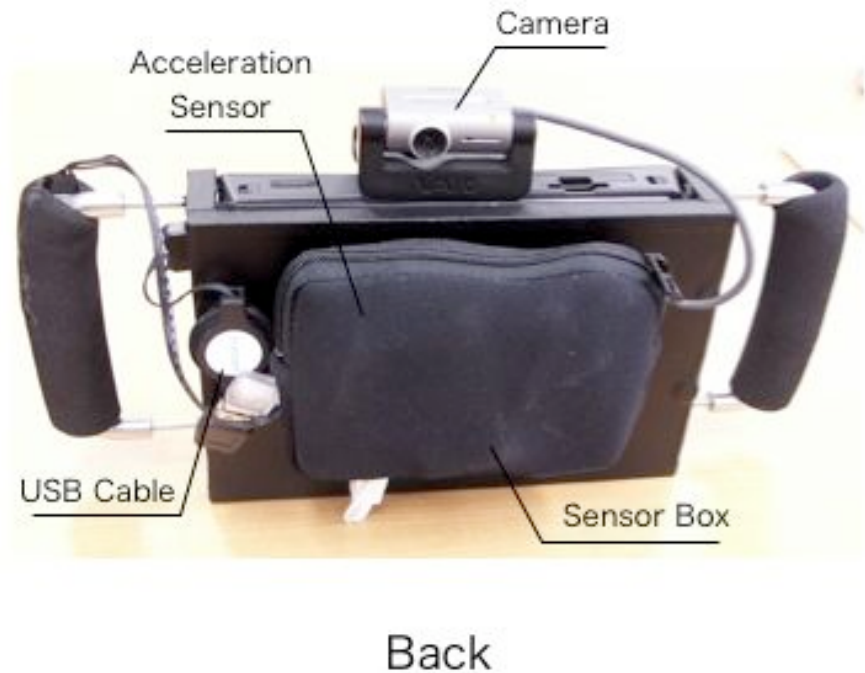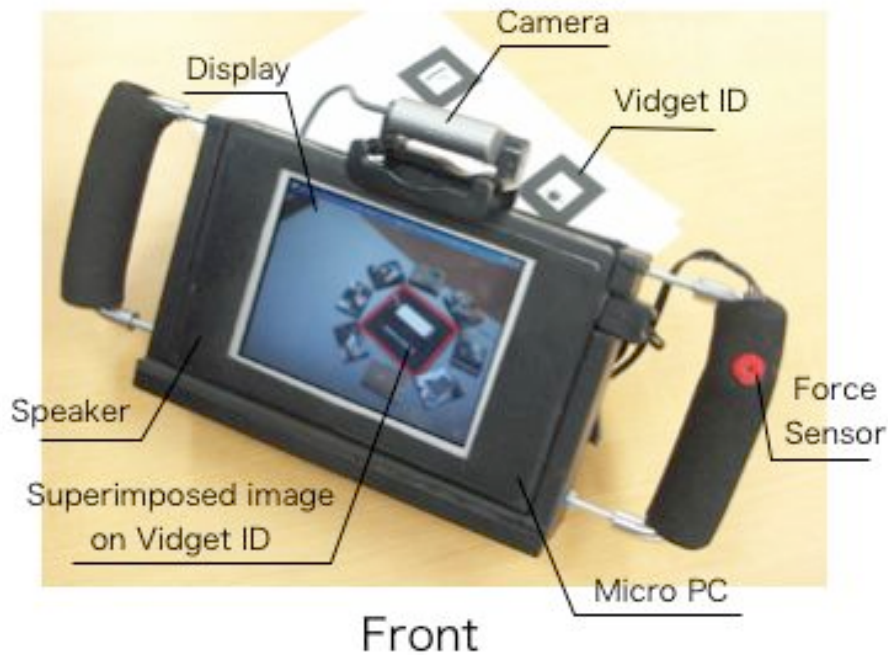
# Vidgets Service

- Photos Ring Interaction

# *Vidgets Service*

- ## Media Dialer Interaction

# Life Style Gaming

- Life style gaming should make our daily life more pleasurable.
  - Increasing motivation to do boring activities like tooth blushing
  - Increasing a user's health and the efficiency in his daily activities.
- Daily activity can be used as inputs of games.
  - Artefacts recognize our daily activities.
  - The life style gaming should be a part of our daily life.
- The output of games is represented in artefacts.
  - Aquarium, Picture, Foliage plant
  - We need not to be aware of gaming.

# Framework for Life Style Gaming
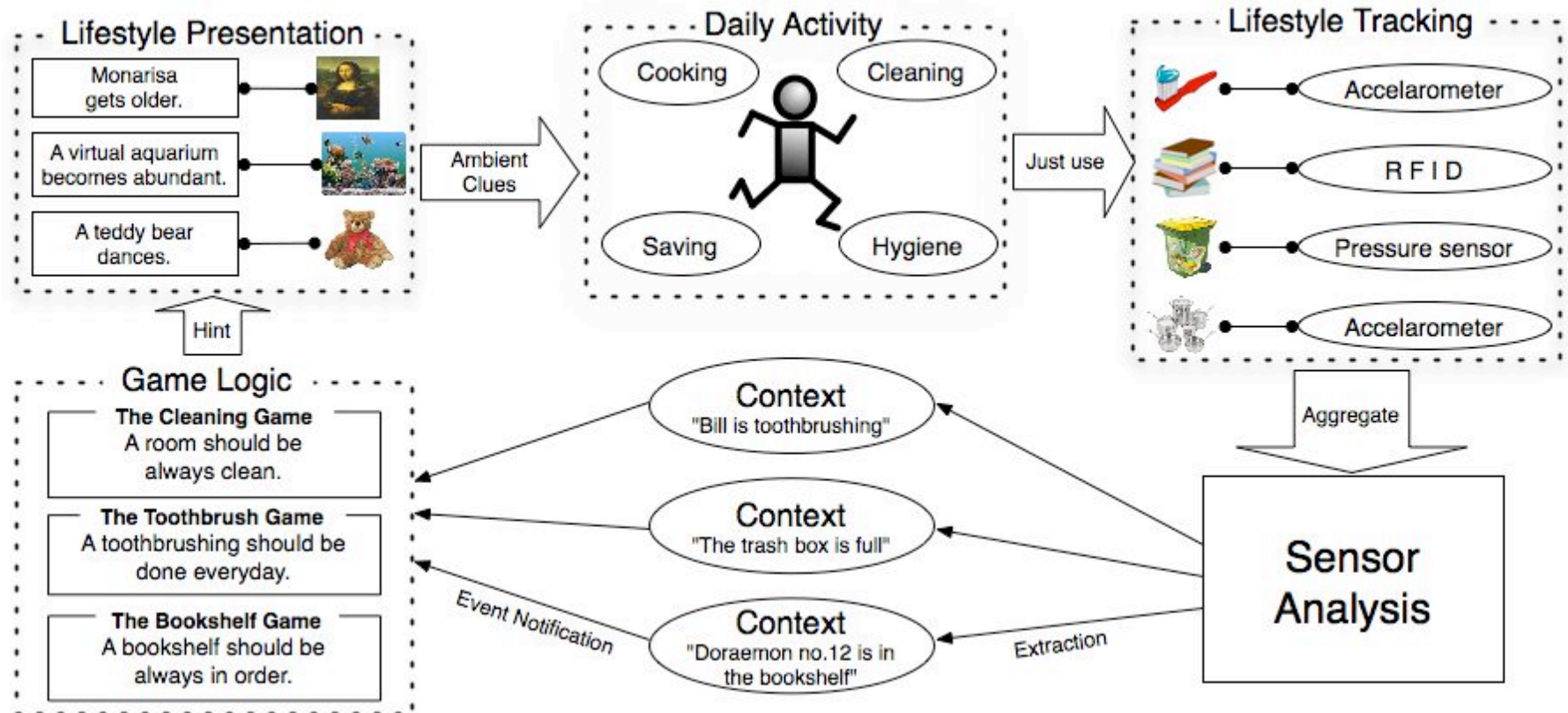


- ## Life Style Tracking
  - – Usual using artefacts become inputs to games.
- ## Life Style Presentation
  - – The presentation of games is a part of our daily life.

# Artefact in Bookshelf Game

- Bookshelf
  - Taking photos periodically by a camera.
  - Each book attaches a visual tag to identify it.
    - Identifying the location, orientation.
  - A user uses the bookshelf in a usual way.

- Picture in a Display
  - A user does not feel uncomfortable when a picture is near the bookshelf.

# The Bookshelf Game
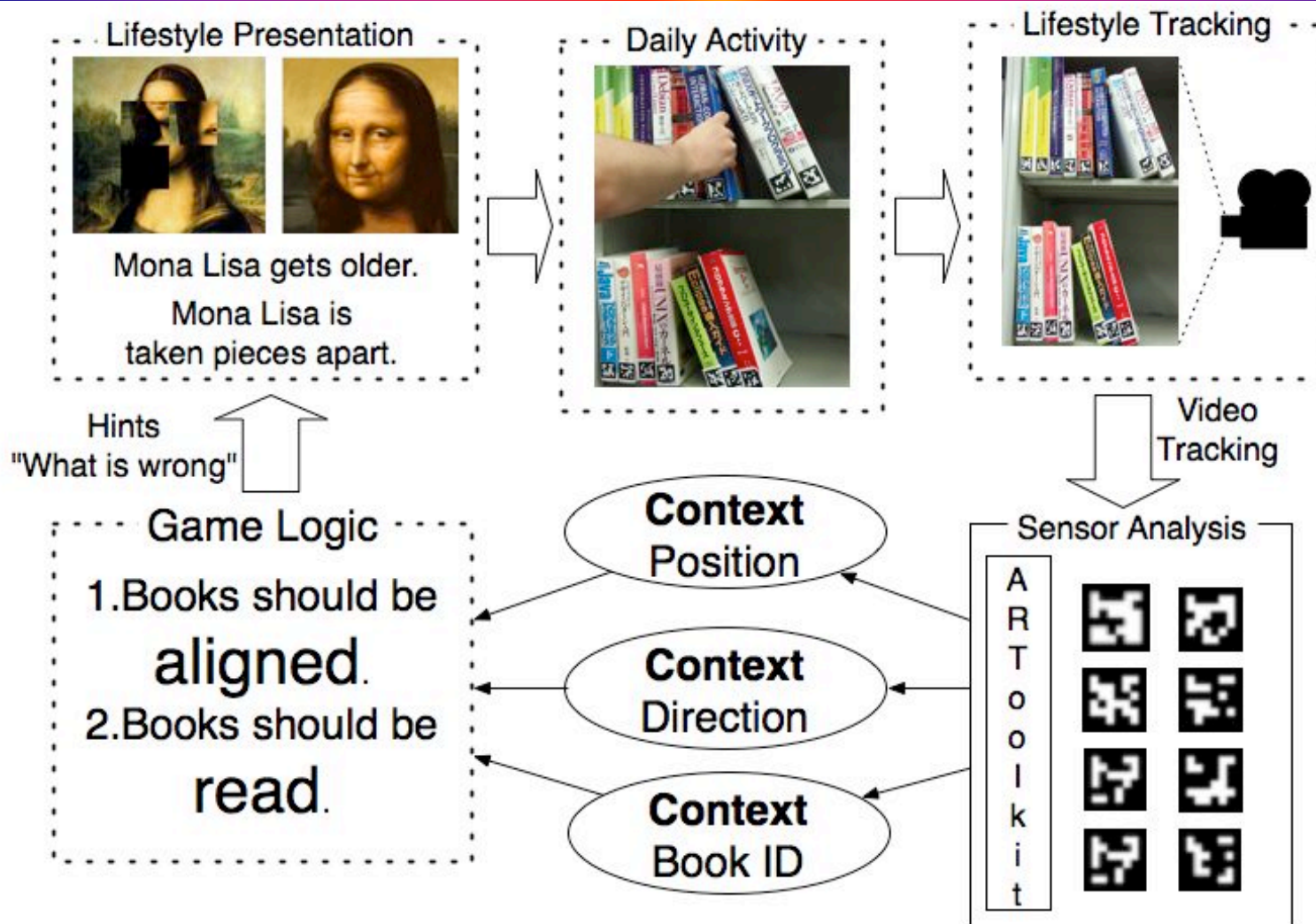
# Life Style Gaming and Interaction

- It is important to identify objects and to know what a user is doing currently.
- In the case study, we use a game concept to clean books up in a bookshelf.
  - Books should be cleaned up.
  - Books should be read periodically.
- The clean up of the bookshelf should be more pleasurable by using a gaming concept.
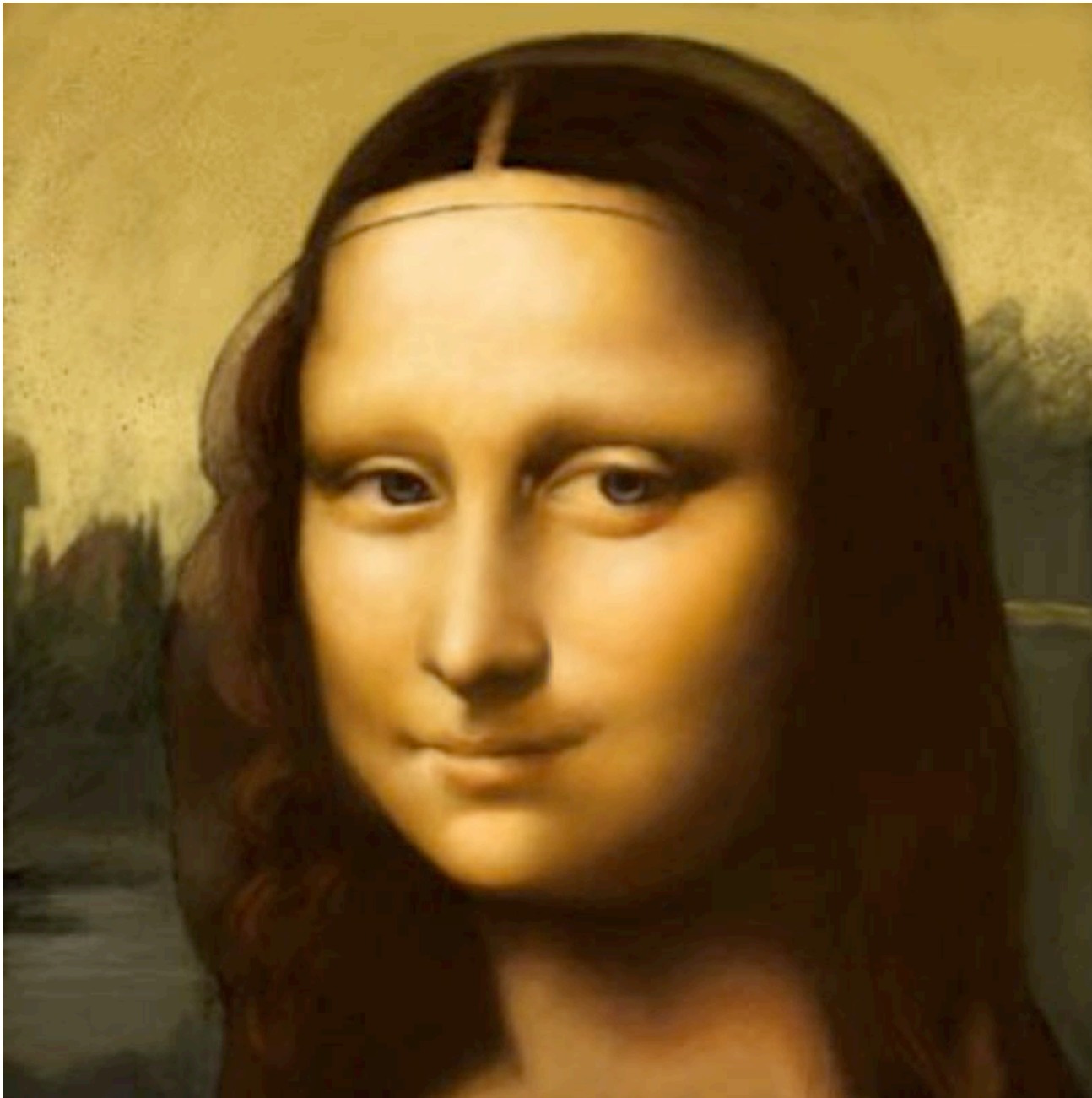
- Original Mona Lisa
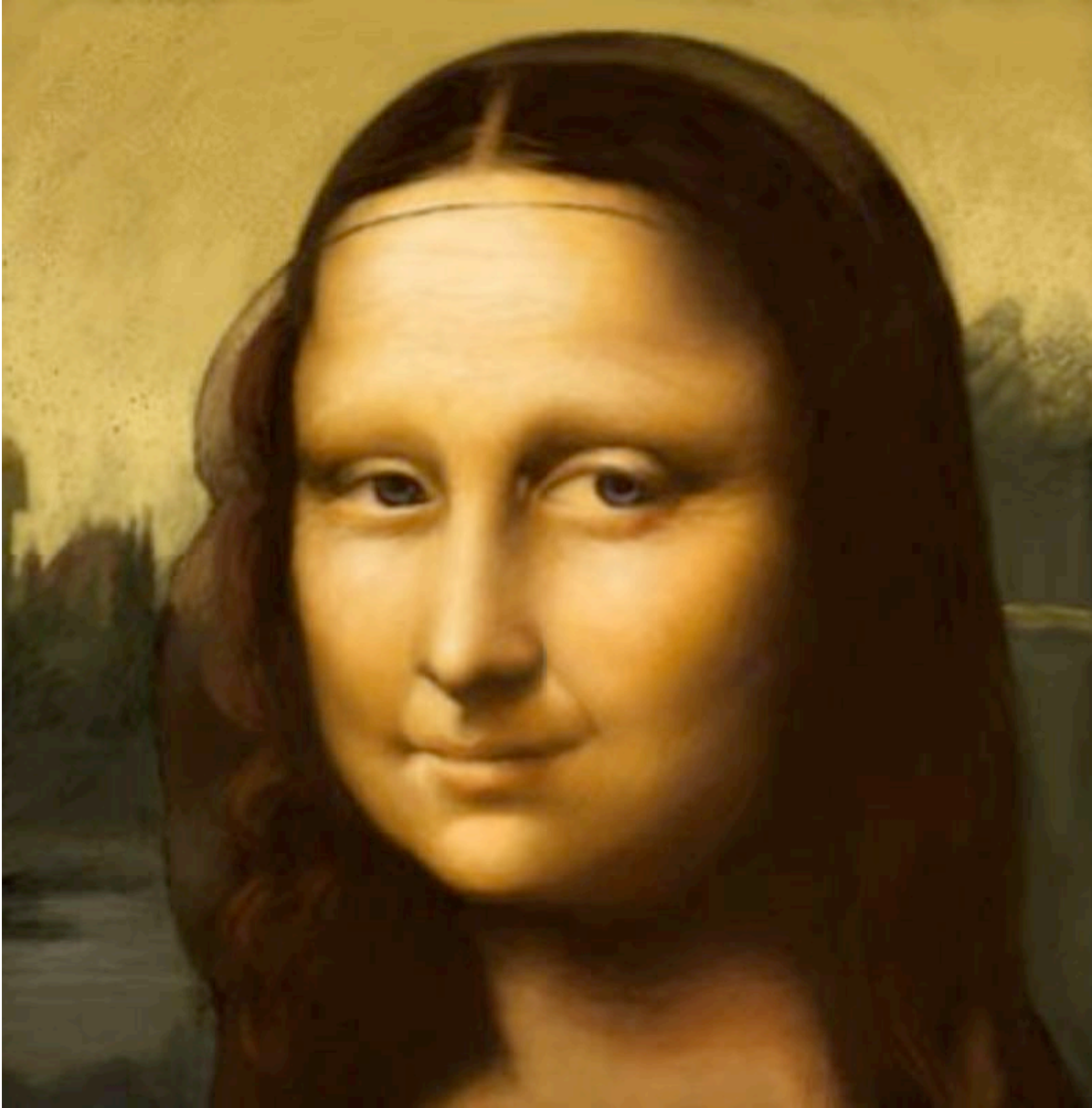
- The bookshelf is put in the order.

Drop out a part of Mona Lisa

Some books are not in the bookshelf

A player likes to put the books in the bookshelf.

- Broken Mona Lisa

- Books are not in oder.
  – The direction of a book isn not correct.
  – The book is lying in the bookshelf
  – The order of books is not correct

- Want to clean up.

- Mona Lisa puts on years.

- A player does not read any books.

- He may want to read books?

- Old Mona Lisa

- A player does not clean up the bookshelf.

- He needs to put new books in the bookshelf.
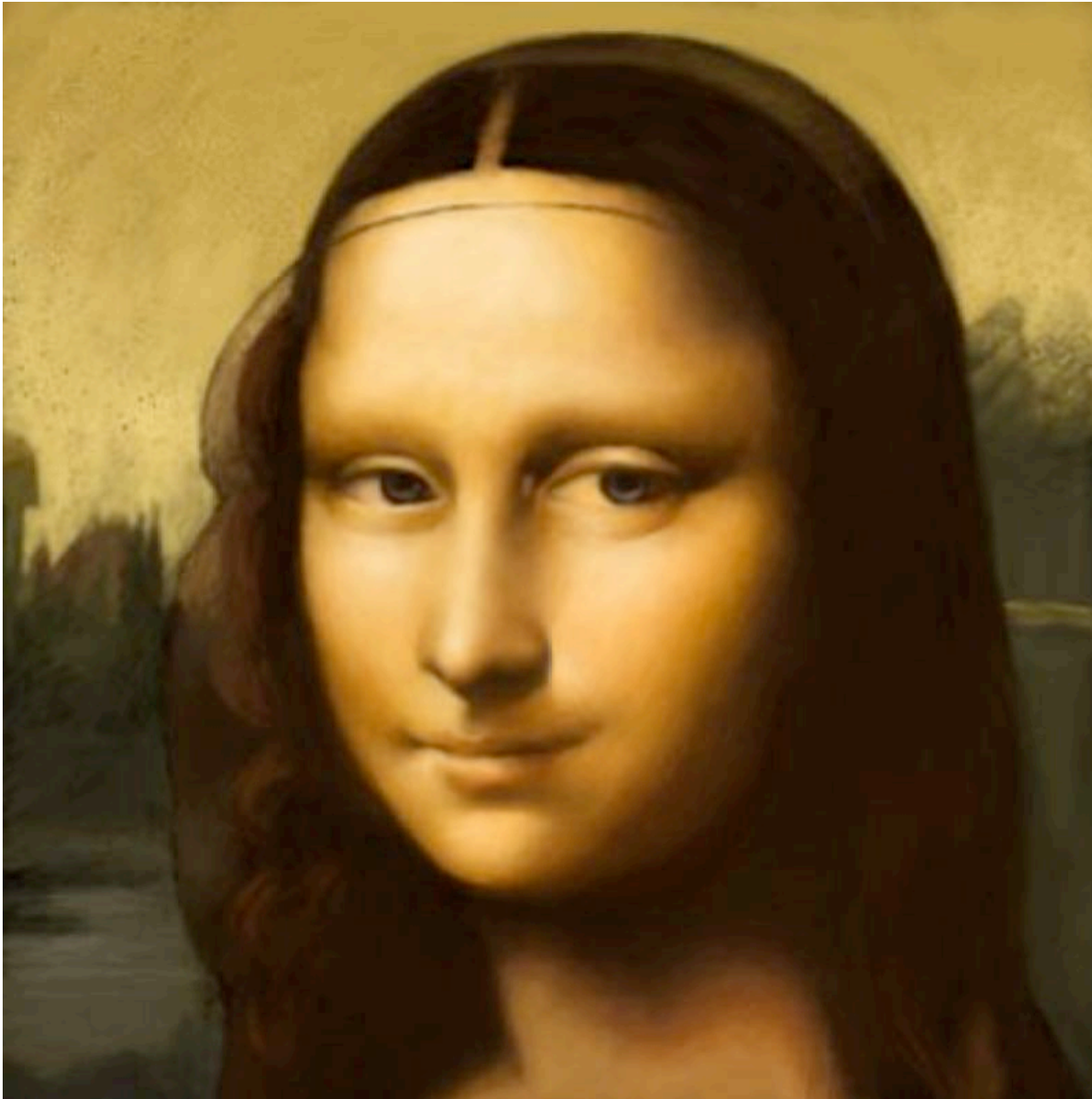
- Mona Lisa is getting younger.

- Books have been read frequently.

# Real World Interaction and Consumption

- ## Virtual in Real World
  - Local services and information dedicated in a specific area.
- ## Virtual in Virtual World
  - The distance is meaningless. The virtual thing needs to have some relation to a real thing.
- ## Real in Virtual World
  - Virtual real thing like money.
- ## Real in Real World
  - Real objects should be identified.

# Conclusion

- Identifying real objects and services is very important in real world interaction.
- We have shown two examples to use real world interaction.
- We need to consider attractive business model in future ubiquitous computing environments.
- The integration of virtual and real is a key to archive the goal.