SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF INFORMATION TECHNOLOGY

16IT AUGMENTED REALITY AND VIRTUAL REALITY

III YEAR – V SEM

UNIT 3 – INTRODUCTION TO VIRTUAL REALITY

TOPIC 4 – Sensors and Behaviours

Introduction

- Specification -

  Implementation - Evaluation

- Immersive VR Systems
  - Gap between implementation & evaluation environment

- VR Development Tools

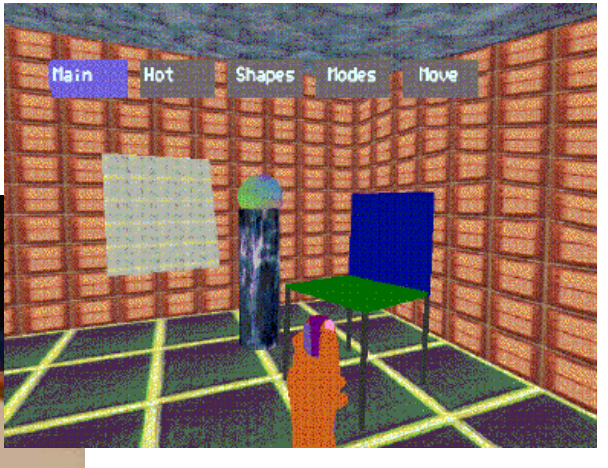
  as Immersive VR Systems

Introduction

- Virtual World with Virtual Objects
  - Virtual Object
    - Form + Function + Behavior [Kim98]
- Constructing a Virtual World within Virtual Environment

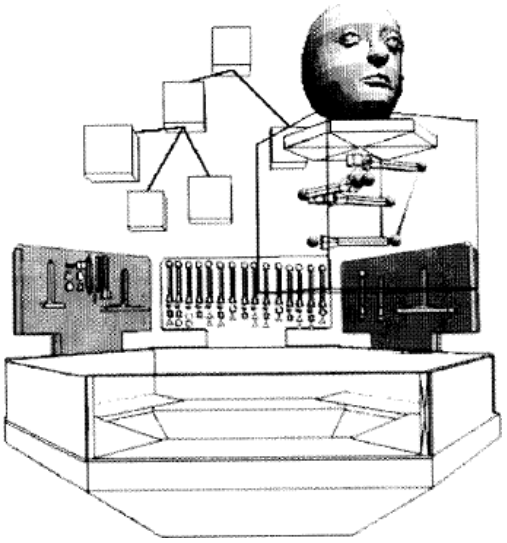
Introduction

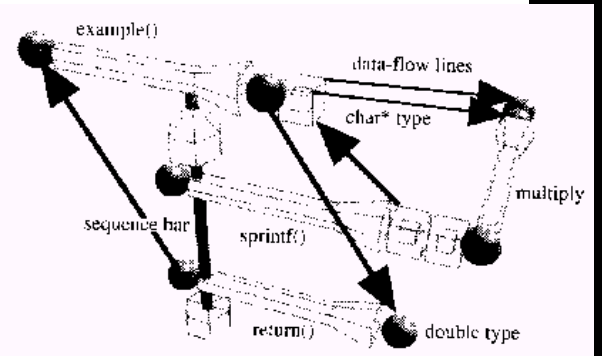
- Related Works
  - 3DM[Butterworth92], JDCAD[Liang94], CDS[Bowman95], ISAAC[Mine95]



Introduction

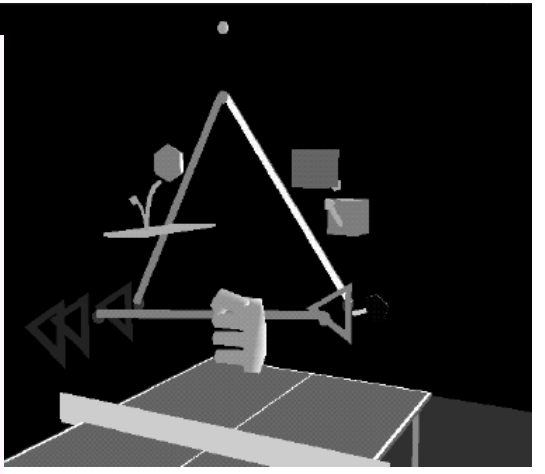
- Related Works
  - Lingua Graphica[Stiles92], Data Flow Representation[Steed96]






```
double example(double num, char *str)
 {
   sprintf(str," %f",(num*num));
   return(num);
 }
```

Fig. 2 *LG Example*



Introduction

- Goal of this work
  - Modeling Virtual Object “Behavior” within Virtual Environment
  - Fully utilizing the merits of the “3D interaction”

Problem

- Immersive VR Systems
  - Provide high level of presence
  - Tracking device, HMD
  - Isolate subject from the real world
  - Hard to use conventional interfaces
- Modeling Virtual Object Behaviors
  - Mostly by text editing task

Approaches

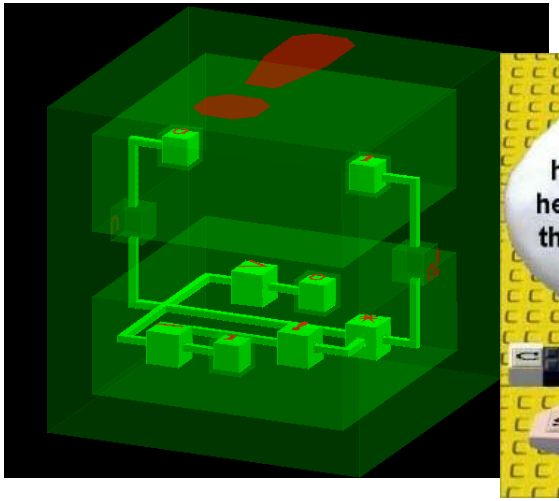
- Virtual Terminal
- Metaphorical Objects
- Programming by Demonstration

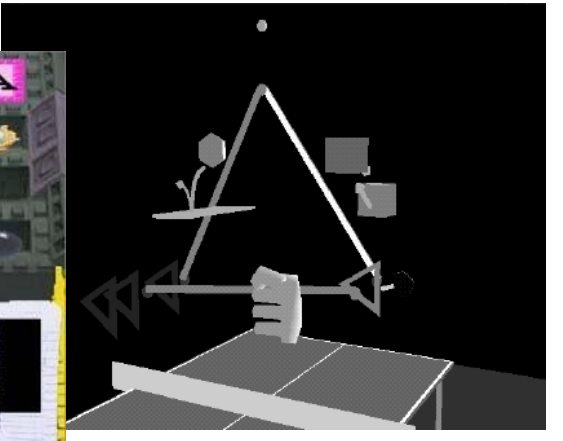
Approaches

- Virtual Terminal
  - Text, 2D Graphics and others
  - Limits of device technology
  - Special alphanumeric I/O devices for VE

Approaches

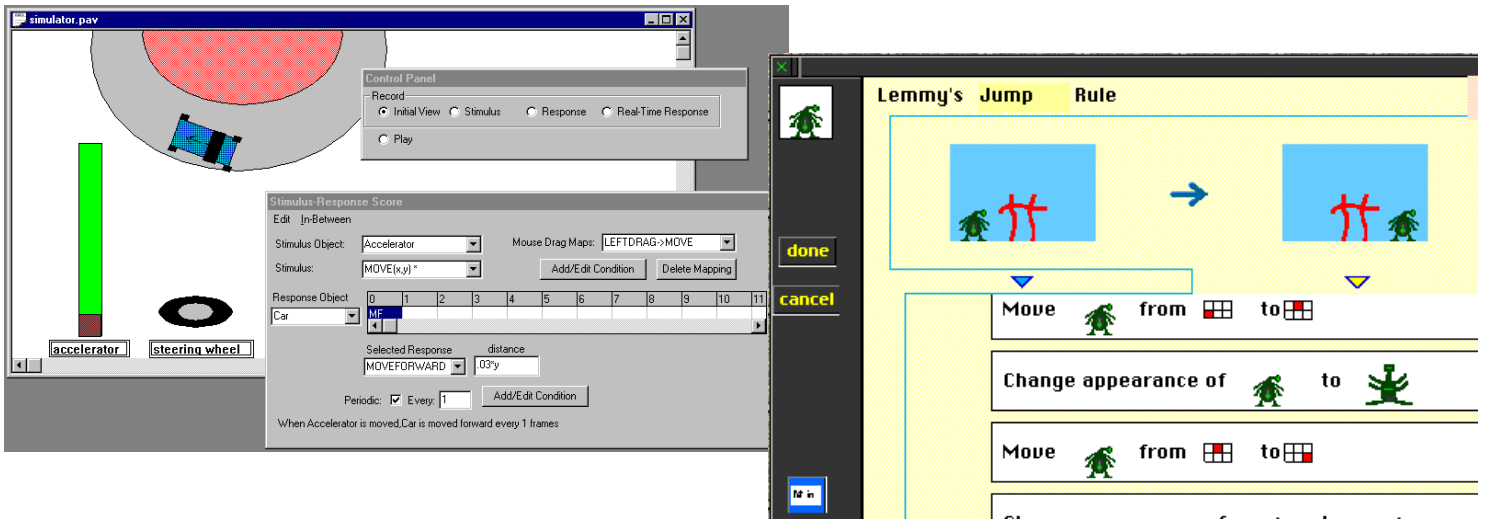
- Metaphorical Objects
  - Visual Languages
    - Cube[Najork96], ToonTalk[Kahn96]
  - Data Flow Representation[Steed96]





Approaches

- Programming by Demonstration
  - "Direct manipulation for programming tasks" [Lieberman01]
  - Pavlov[Wolber97], KIDSIM[Smith94]

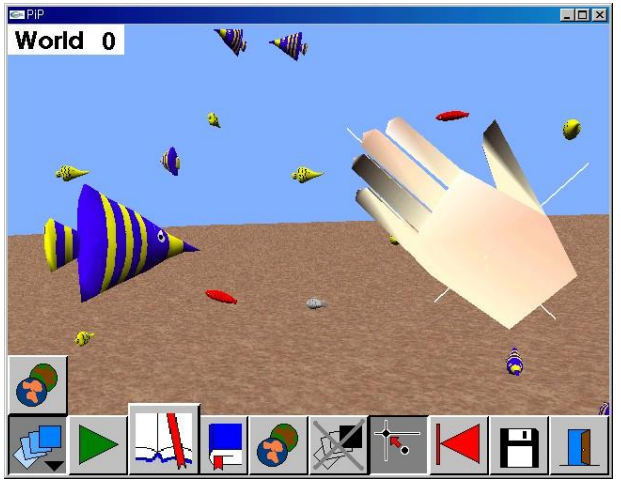


The PiP System

- **P**rogramming virtual object behavior **i**n virtual reality **P**rogram
- Filling out the virtual object behavior model using 3D interactions

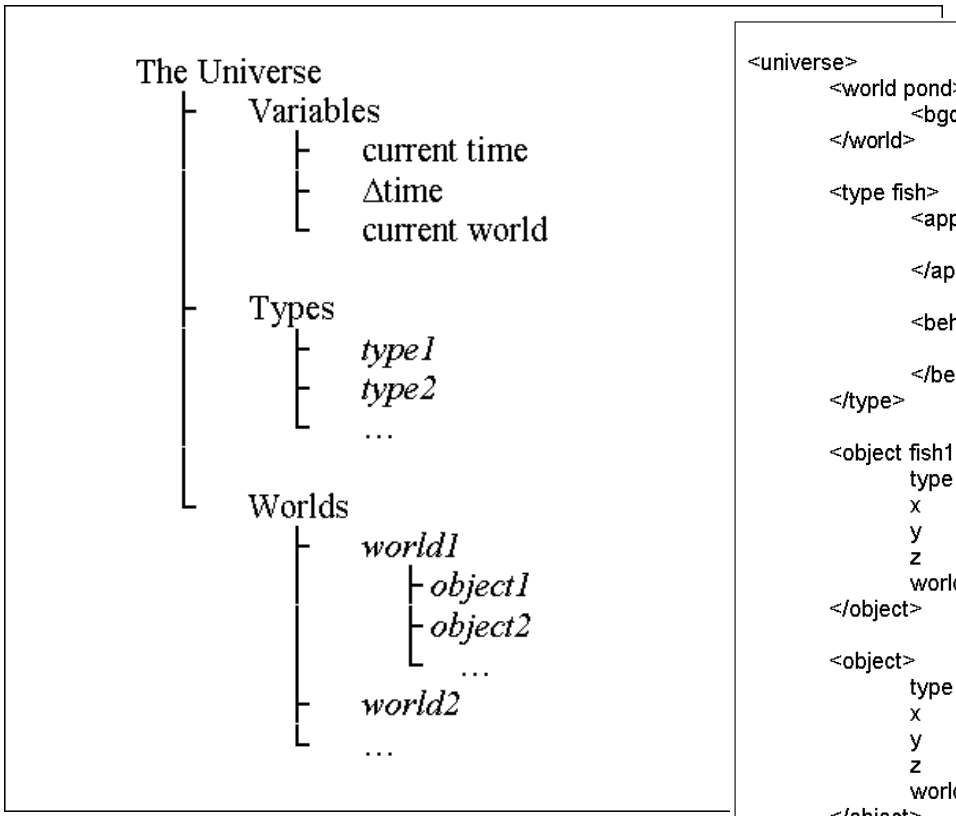
The PiP System

- Implementation
  - Hardware
    - PC platform
    - HMD
    - Fastrak
    - 5th Glove
    - 3-buttoned prop
  - Software
    - Microsoft Windows OS
    - OpenGL



The PiP System

- Virtual World Model




```
<universe>
        <world pond>
                <bgcolor        1.0 1.0 1.0>
        </world>

        <type fish>
                <appearances>
                        default         fish.obj
                </appearances>

                <behavior>
                        <action moveforward 1.0>
                </behavior>
        </type>

        <object fish1>
                type            fish
                x               100
                y               100
                z               100
                world           pond
        </object>

        <object>
                type            fish
                x               -50
                y               200
                z               100
                world           pond
        </object>
</universe>
```

The PiP System

- Virtual Object Model
  - Form
    - Type, Position, Orientation, World, Appearance, Sound & User defined variables
  - Function
    - Change Variable(=, +, -, *, /, %), Create, Destroy, Move, Rotate, Scale, Play Sound
  - Behavior

The PiP System

- ACE Behavior Model
  - Event
    - Collision, Property Value Changed, Timer
  - Context
    - Spatial
    - Non-spatial
  - Action

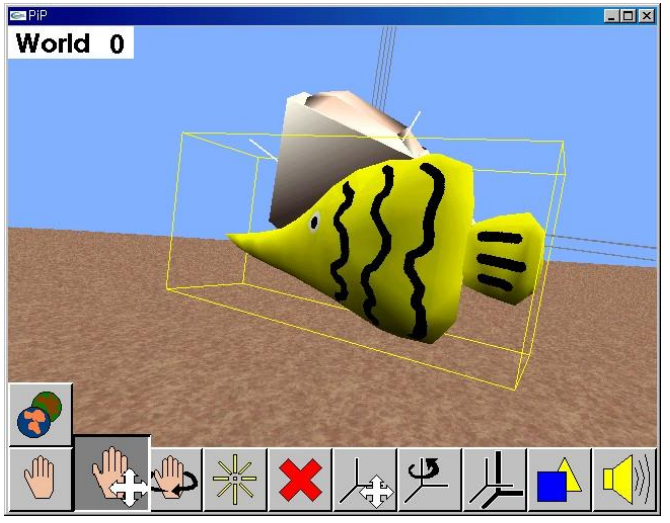
The PiP System

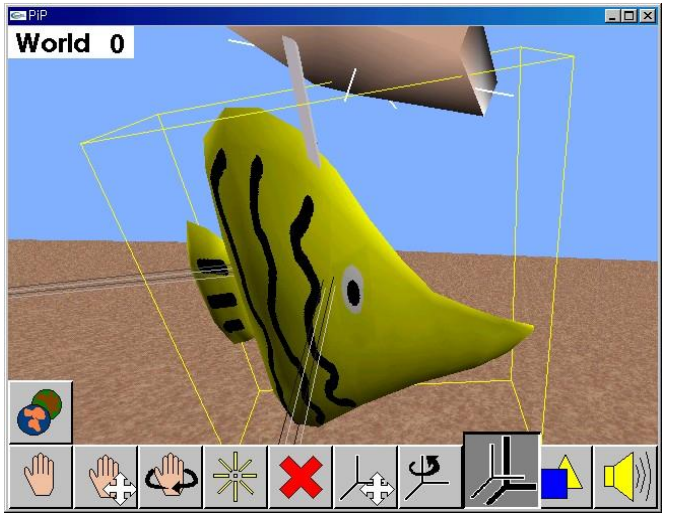
- Example behavior “eat food”

```
<behavior>
        <event collided food>

        <context>
                <roi back    -10 –10 10    10 10 20   empty>
                <thisObject appearance != 1 >
        </context>

        <action>
                <moveforward 1.0>
                <destroy eventedObject>
        </action>
</behavior>
```

The PiP System

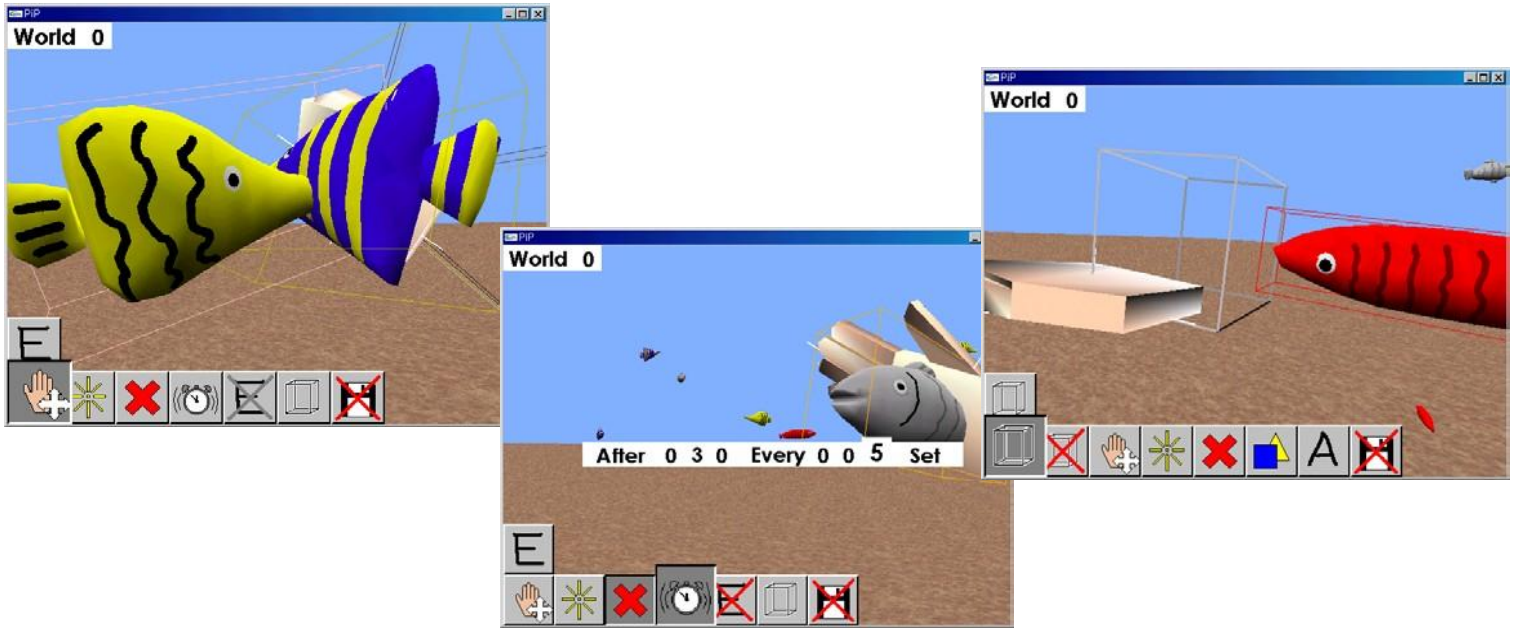
- Interacting with Virtual Objects
  - Virtual Hand, 3D Widgets, Menu
    - Create, Destroy, Move, Rotate, Change Appearance and Play Sound



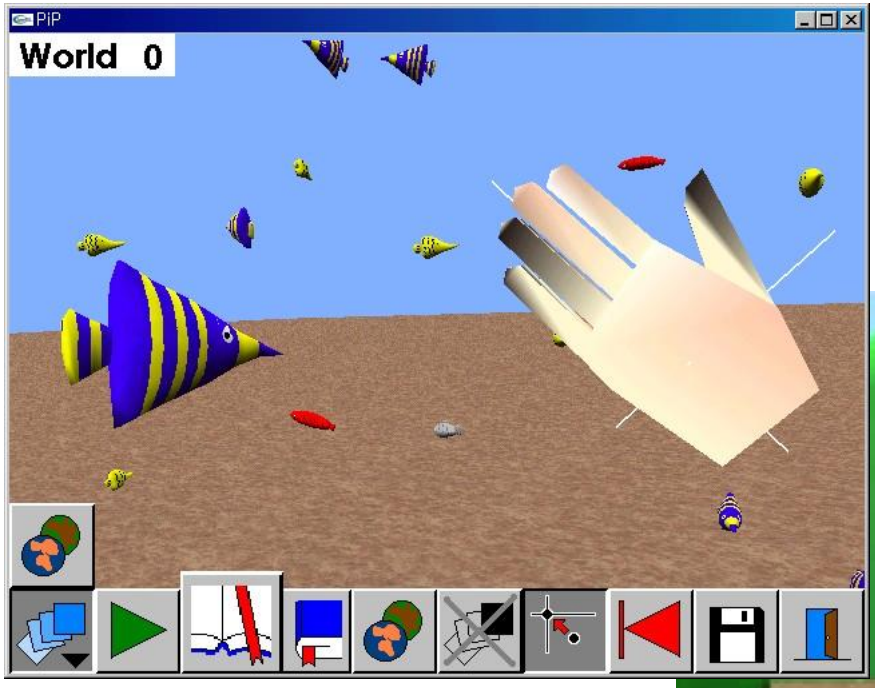


The PiP System

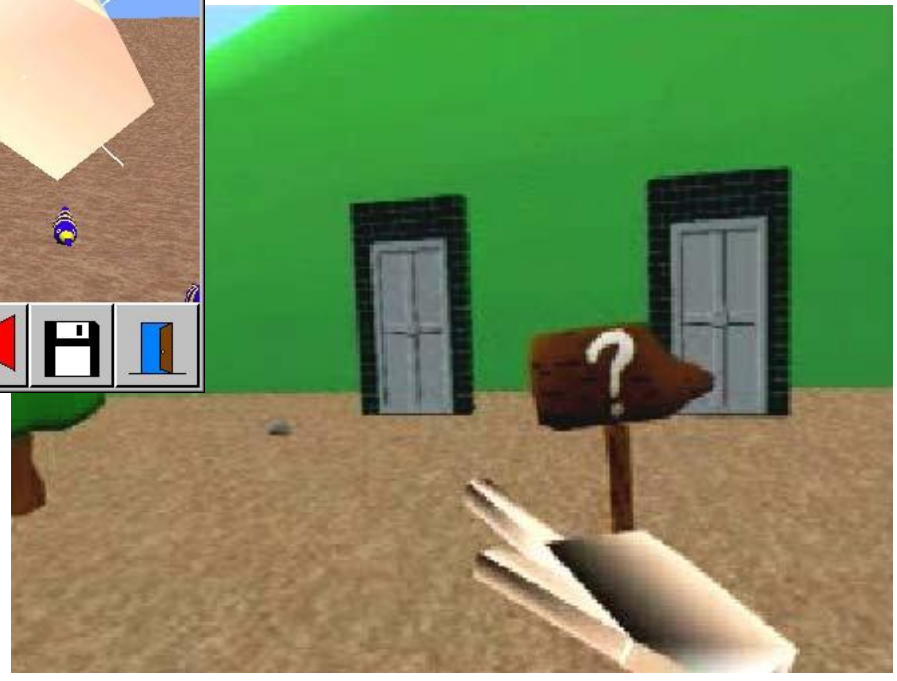
- Interactions for Behavior Modeling
  - Demonstrating Event, Contexts and Actions



Modeling Results



Virtual Undersea World



Romancing the Stone

Modeling Virtual Object Behavior within Virtual Environment

Virtual Reality Laboratory
POSTECH

Conclusion & Future Works

- Categorized approaches for modeling VO behavior within VE
- The PiP System
- Usability tests with other approaches and interfaces
- Virtual Object Models and 3D Interaction Methods

Thank you!

Virtual Reality and Interactive Media Laboratory, POSTECH
http://vr.postech.ac.kr

References

- Please refer to the paper.