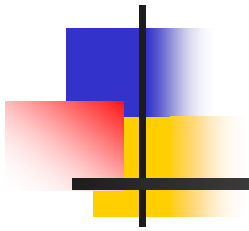
Research Activities at Multimedia University

16 December, 2004
At Kyoto University



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1. About myself
Personal history

Name: Ryoichi Komiya

Nationality: Japanese

Birth place: Tokyo

Graduated from Waseda University (Tokyo Japan) in 1967

Ph.D. from Waseda University in 1986

Family: wife, daughter (got married), son (sales man of electrical measurement equipment)

1.2 Personal R&D history

March 1966: Industry training at NTT Labs
March 1967: Graduation from Waseda University
Entered NTT Labs in 1967.

1.3 Reasons I entered NTT Labs

1. Met with wonderful and attractive R&D people during industrial training: Dr.Shigei and Dr.Kuroyanagi

2. Active and lively environment of the laboratories: Starting of high speed digital transmission systems over coaxial cable

3. Splendid test equipment and latest devices : HP sampling oscilloscope and high speed transistors and tunnel diodes imported from the U.S.A.

1.4 R&D places involved and major activities

NTT Labs (1967-1992)
Digital Subscriber Line
ISDN access line systems

Siemens (1992-1995)
ATM

Nippon Telecommunication Systems Consulting (1995-1998)
Telecommunication systems software

Multimedia University (1998-2001)

Virtual reality telecommunication systems

Distribution and Logistics University (2002-2003)
Application of IT to distribution and logistics industries

Multimedia University (2003-)
Mainly ICT

Since 1967, I have dedicated myself to R&D for 36 years.

2. What is R&D?

To define some specific problems in your field (ICT) by Research and to find useful solutions (products) by Development.

The products should contribute to the society in the end.

3. My R&D activities at MMU

Two major streams of our research activities

- Virtual Reality Telecommunication Systems

  You can talk with your friend as if he/she were in front of you.

- E-learning

  More studies during shorter period of time.

3.1 VRTS Research backgrounds

- Telephone services saturation
- Telephone services limitations

(e.g.) lack of non-verbal communication message transfer, more human friendly message transfer

- Internet services limitations

(e.g.) real time person to person multimedia telecommunication

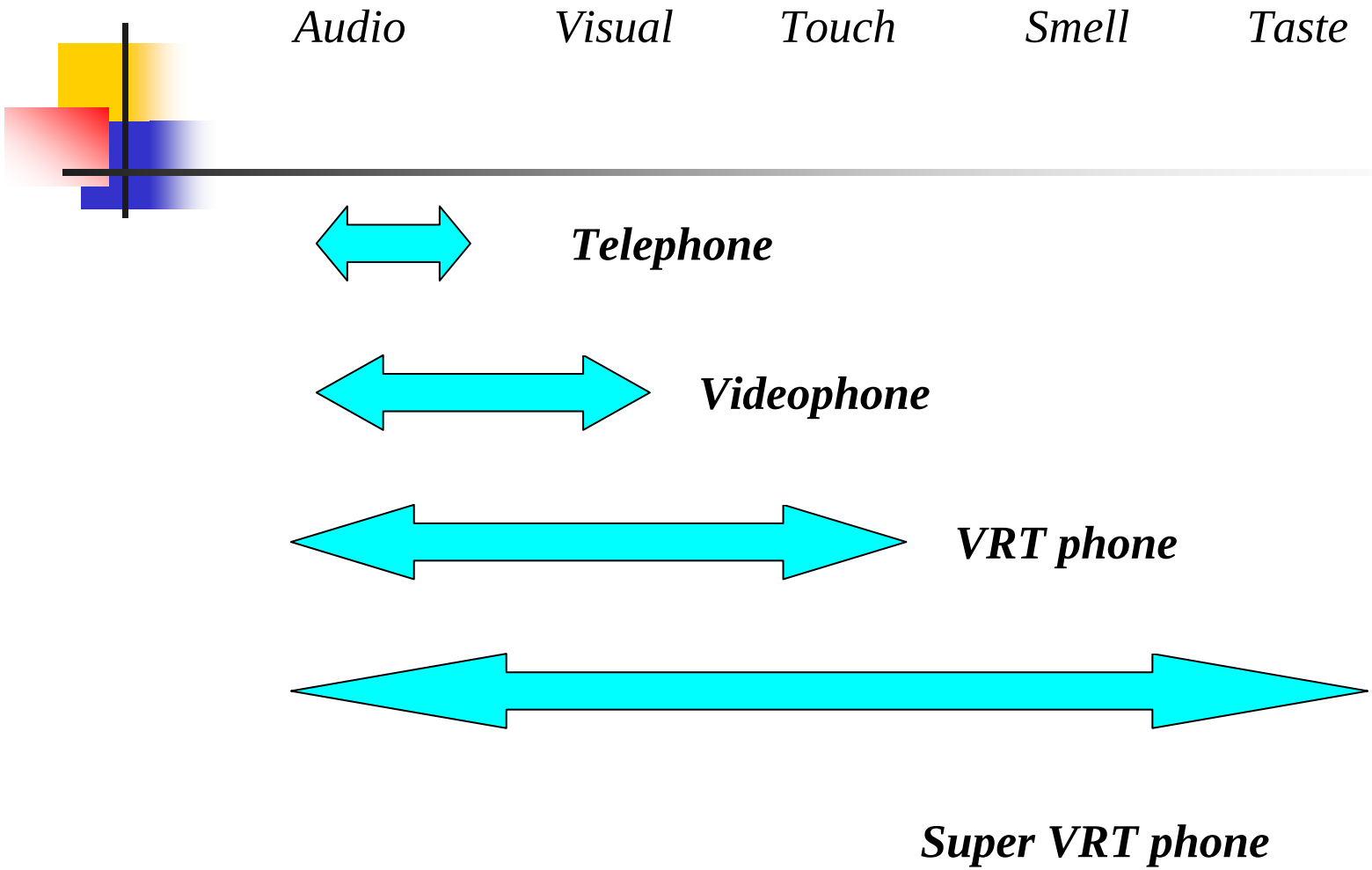
3.2 Difficulties of New Services Creation

Teleconferencing
Multimedia information retrieval
Tele-action (alarm and surveillance)
Remote education
Tele-office
Tele-medicine

Tele-collaboration

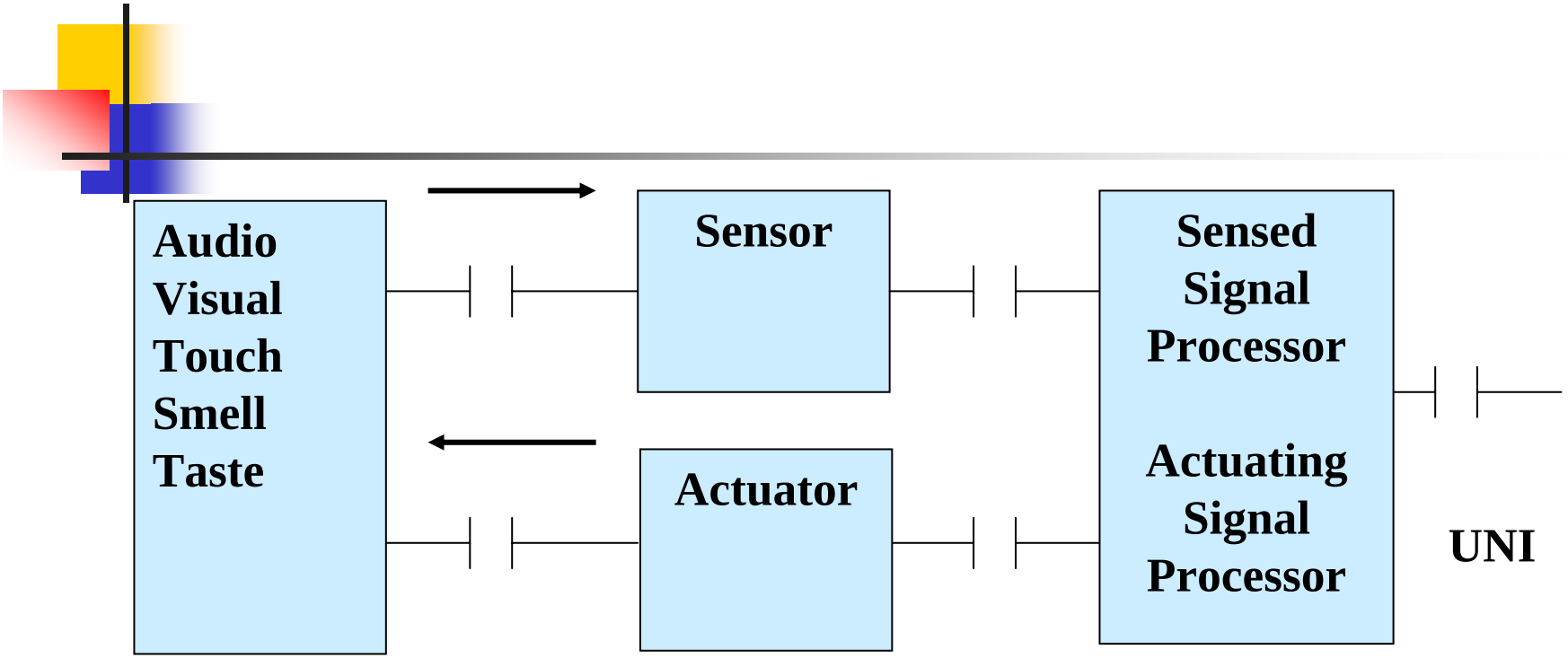
(note) How many services do you know?

3.3 Media to be covered by VRTS



3.4 Interface reference model for VRTS

MMU



We intend to transmit any information detected by five human senses.

3.5 E-learning Research backgrounds

- From paper learning to paperless learning
- From three or four year learning to more efficient learning
- From routine learning to creative learning
- From compulsory learning to spontaneous learning
- From hard learning to enjoyable learning
- From high cost learning to low cost learning

3.6 Multimedia Textbook

Objectives

- To reduce the learning time
- To deepen levels of understanding
- To facilitate learning using different media
- To adapt a self-paced learning
- To follow the latest trends of the industrial society
- To provide dynamic study methods

4. Detailed presentations of R&D

4.1 Three Dimension (3D) Videophone System

4.2 Super High Definition Videophone System

4.3 Cameraless Mobile Videophone System

4.4 Gesture-phone System

4.5 Our Final Target

4.6 E-learning

4.1 Three Dimension (3D) Videophone System

Details will be presented by Mr. Nor Azhar!

4.2 High Definition Videophone (Proposal)

MMU

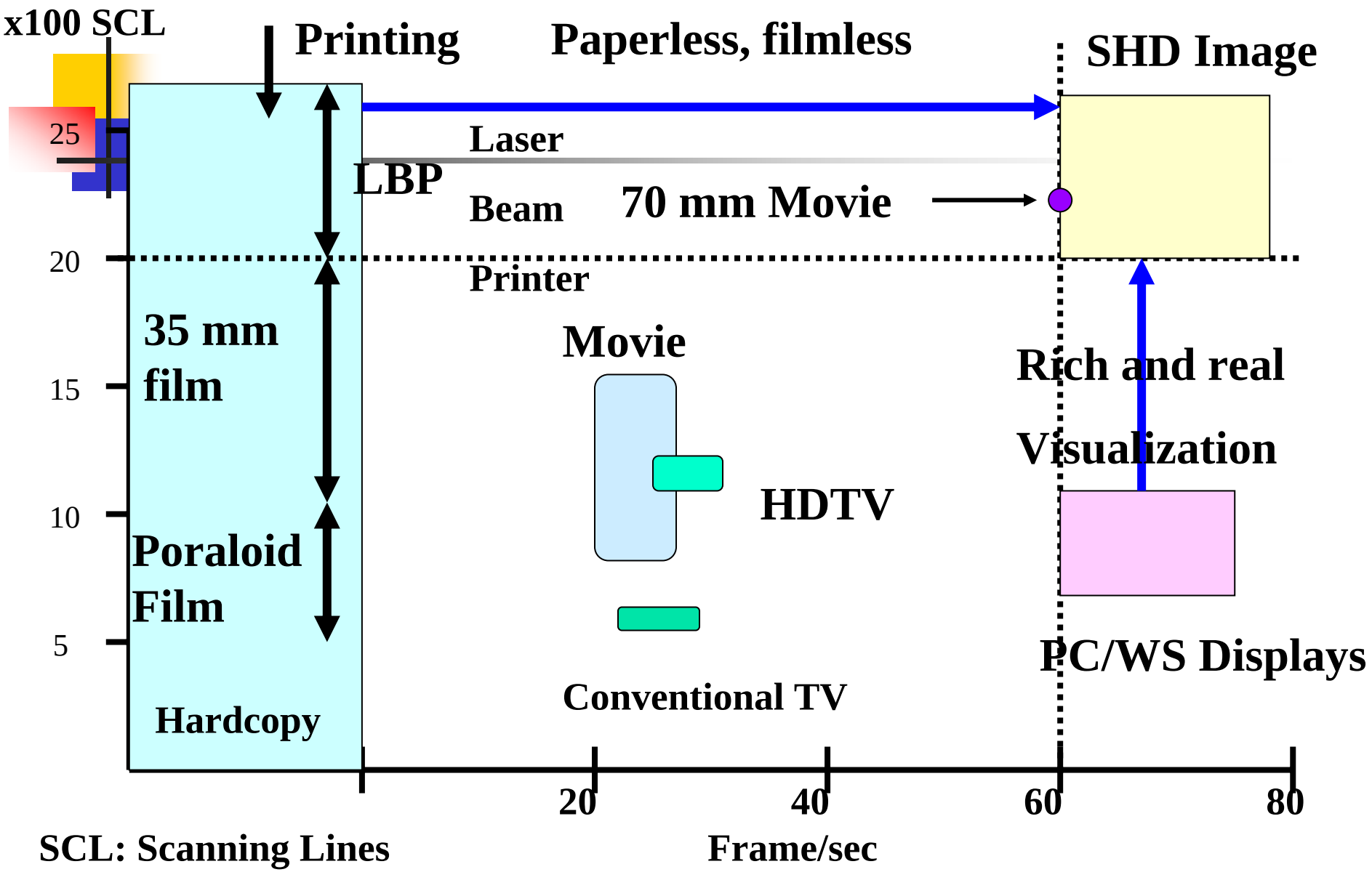
http://www.sony.jp/products/Professional/c_c/creative_shooting/issue02.html

4.2.1 HD Videophone features

1. HD display picture elements:1920 (H) x 1080(V)

   (Aspect ratio 16:9)
2. High resolution similar to 35 mm cinema
   films
3. Color regeneration is realistic and natural
4. 3D sensation in such a high resolution image

4.2.2 Characterization of image media



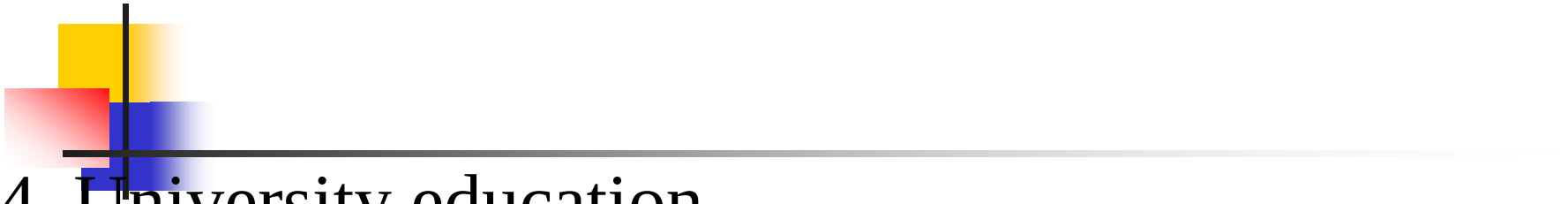
4.2.3 Service applications

1. Transmission of an entire environment of an office and a room together with the talking party
2. Realistic conference talk and person to person talk.
3. Environment sharing e-commerce.

(E.G.)

It will be conducted by connecting actual shopping mall and a user. He can talk with salespeople to choose his suit size, sending his entire physical size images via camera for real time fitting.

Service applications (continued)



4. University education
5. Tele-pathology for medical applications
6. Information retrieval services of the Encyclopedia Britannica, world museum visits and movies

4.2.4 Intended users

1. Medical schools
2. Hospitals
3. Universities
4. Museums
5. Future dot com companies

4.2.5 Focus on HD Videophone System research work

MMU

1. Display implementations: desk top, projector, wall hanging, thin
2. Easy to maintain
3. Low power consumption
4. Light weight
5. Easy to move

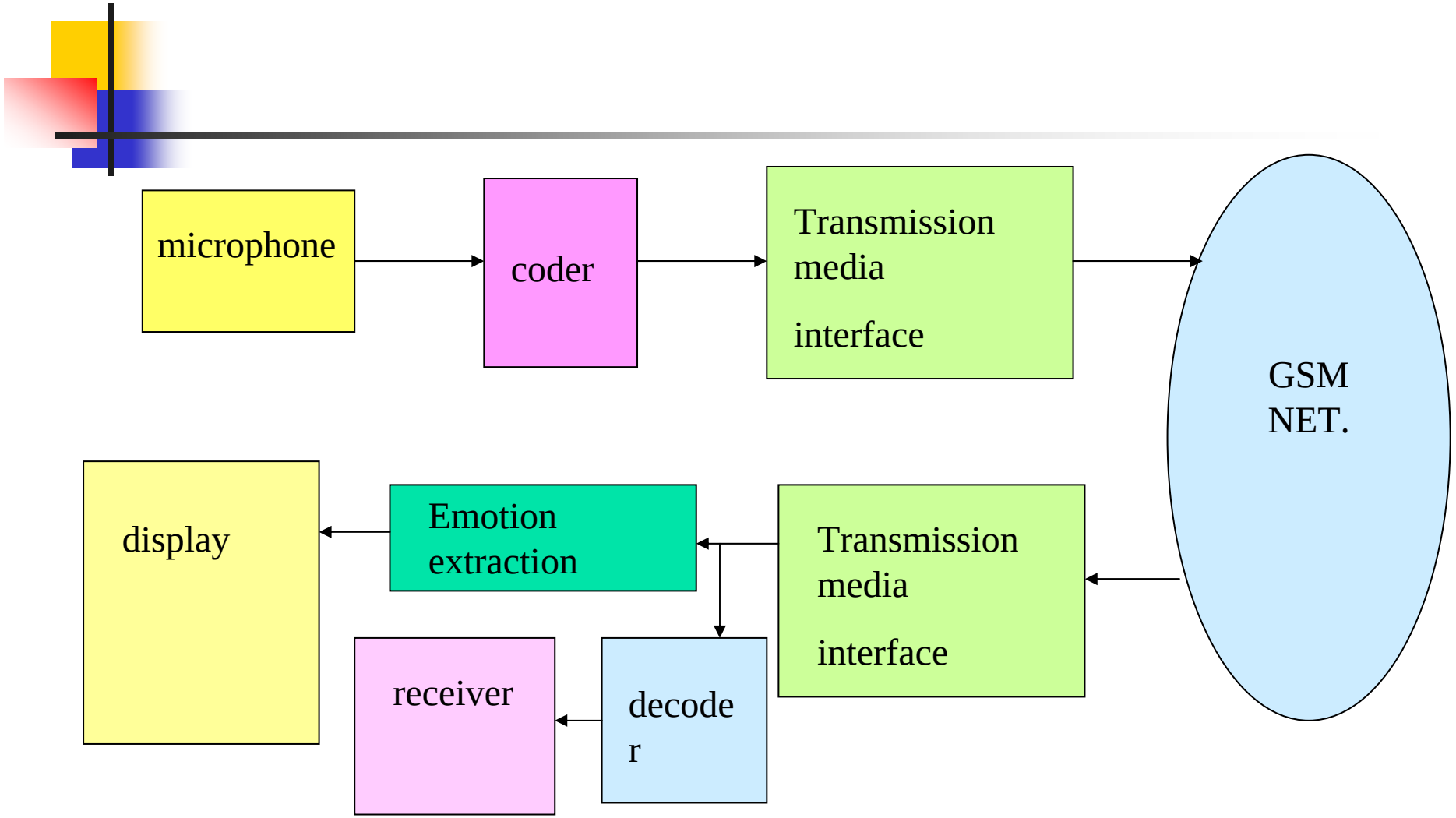
4.2.6 Hardware implementations

Items	Hardware
Sensor/Actuator Module	HD CCD camera Microphones HD LCD display Speakers
Processing Module	MPEG 2/4 Other services pr
UNI	10BaseT, 100Bas

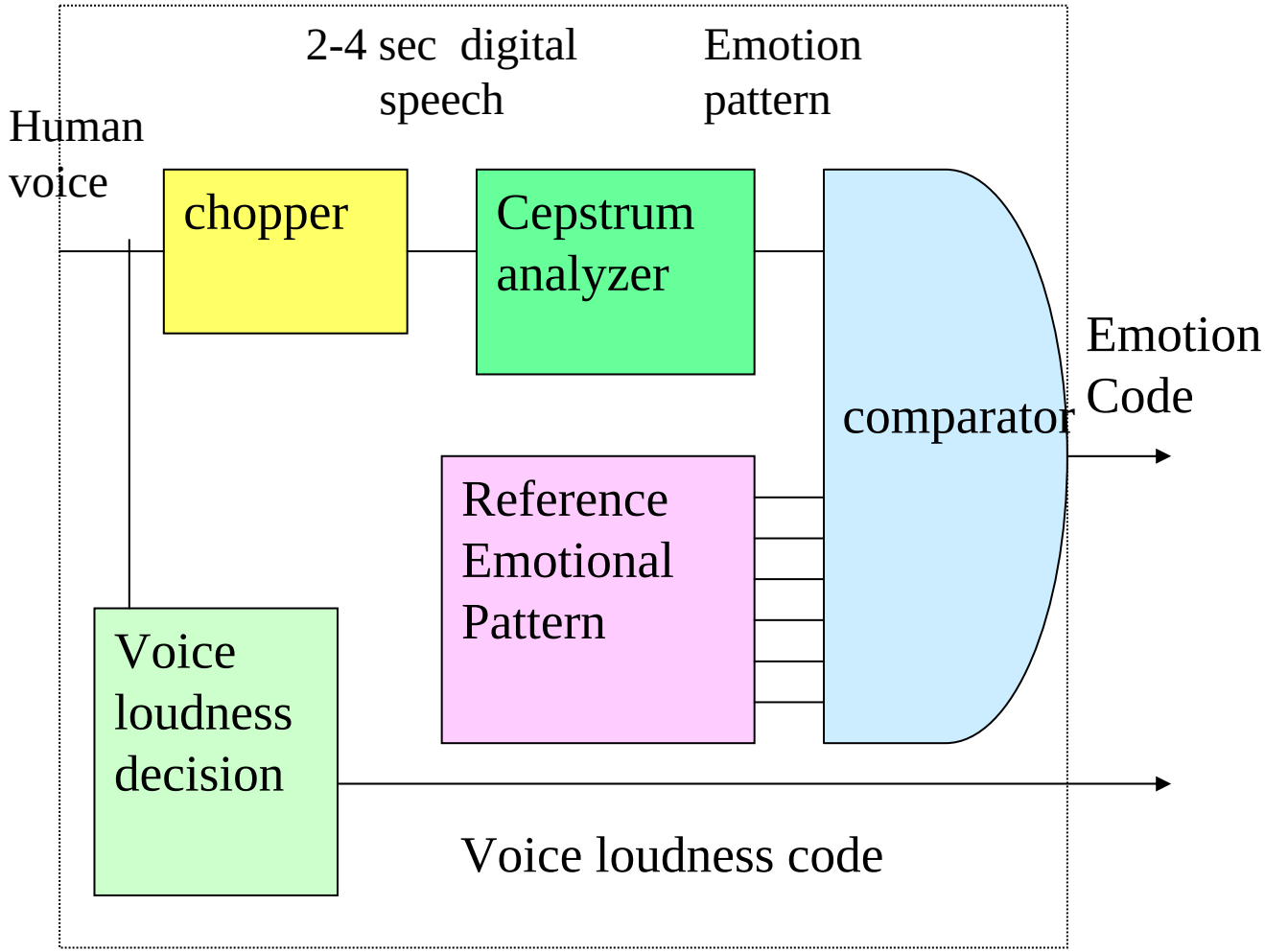
4.3 Cameraless Mobile Videophone

http://www.nokia.co.jp/index.shtml

4.3.1 CMV network configuration

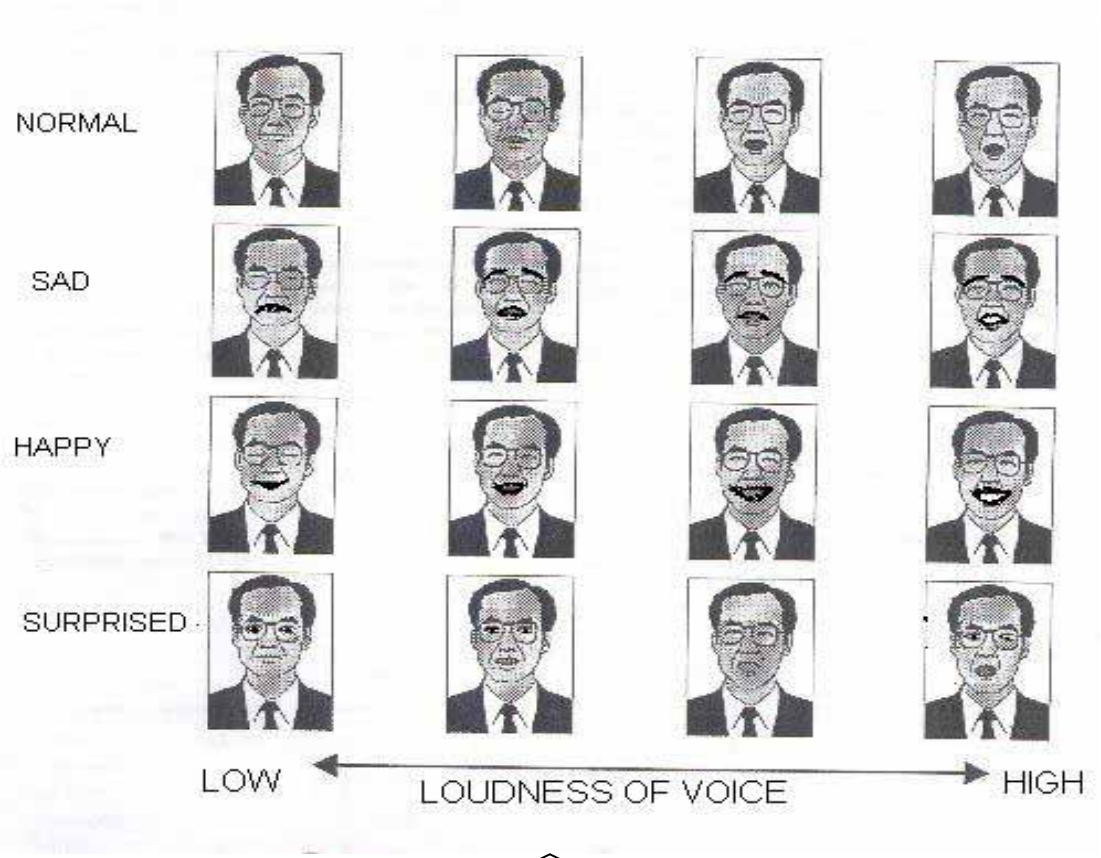


4.3.2 Emotion extractor



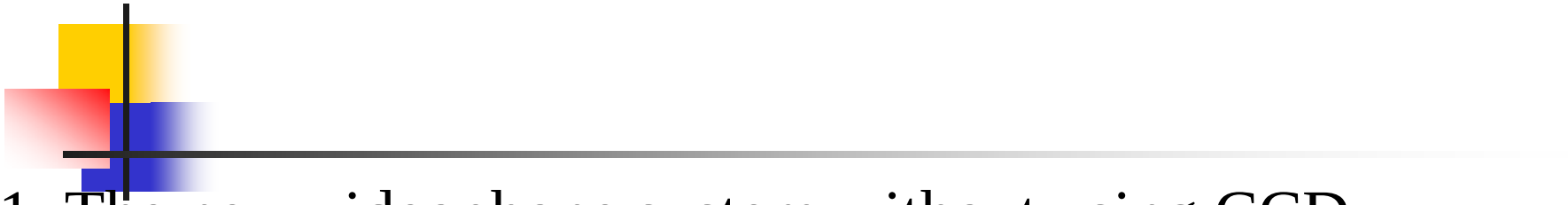
4.3.3 Voice to image conversion

Emotion code



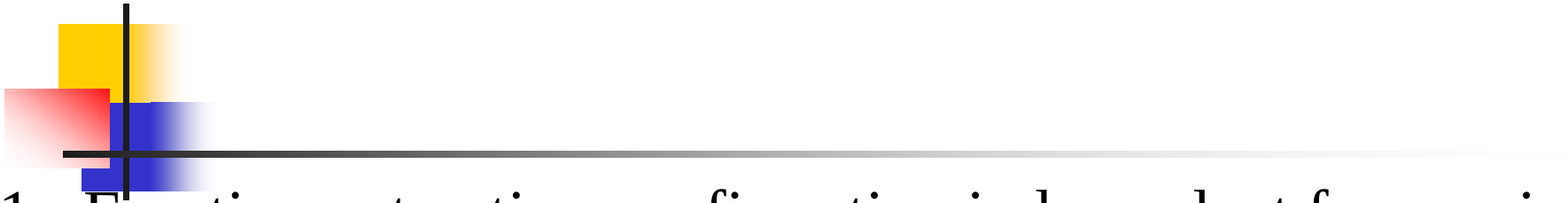
Voice loudness Code

4.3.4 Features of the CMV system



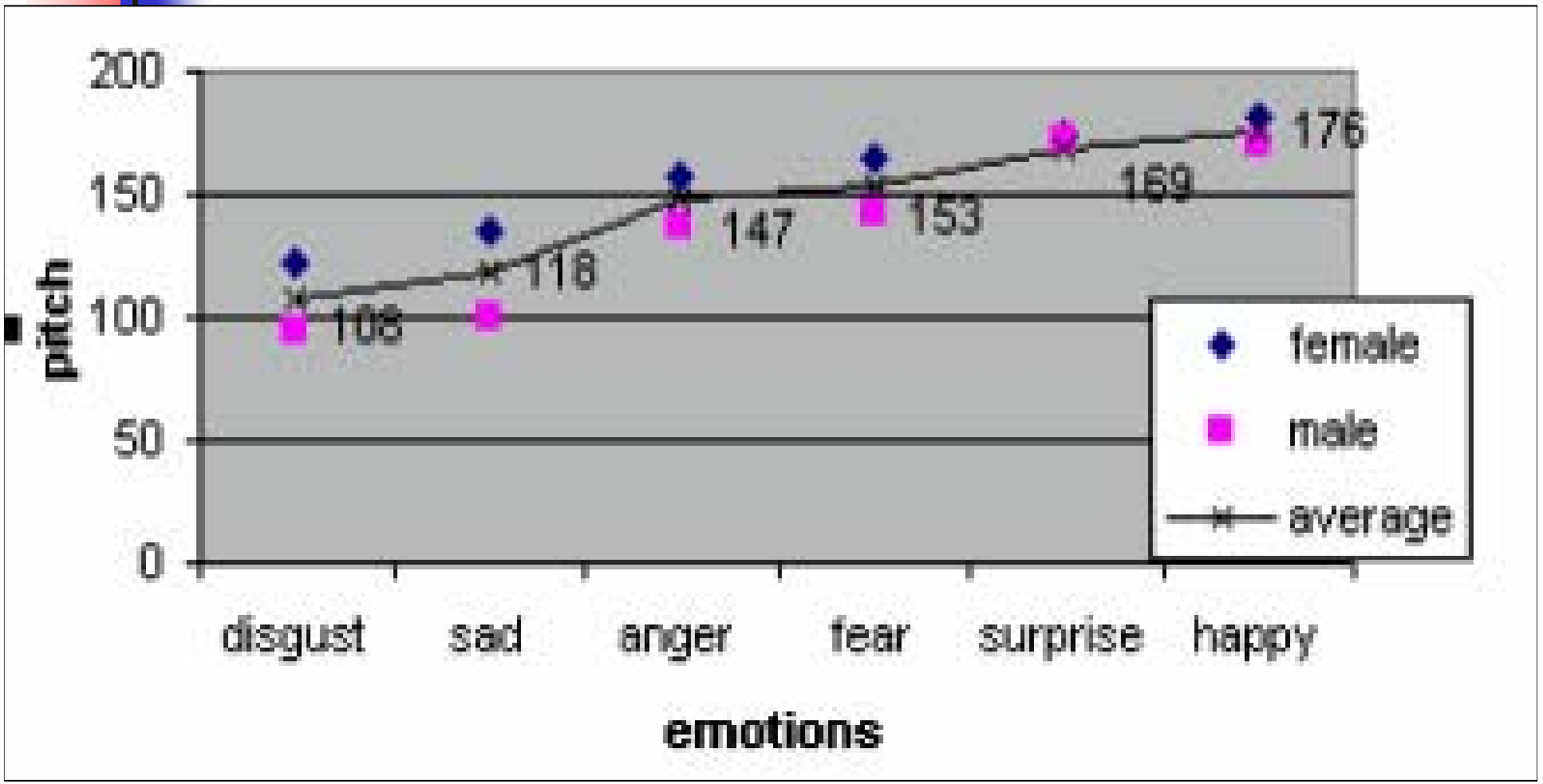
1. The new videophone system without using CCD camera
2. Facial expressions at the receiving end are to be reconstructed based on the extracted emotions from received voice tones.
3. The existing GSM can be utilized for this service
4. No change of the phone size and power consumption from the today's mobilephone
5. 3G infrastructure is not necessary for the videophone applications

4.3.5 Focus on CMV System research work



1. Emotion extraction confirmation independent from voices of gender and age groups
2. Emotion recognition accuracy by different recognizer configurations
3. Universal speech emotion database design as reference emotional speech
4. Artificial face expression movement algorithm design based on six emotion
5. Verification of random eyes and mouth movements

4.3.6 Voice pitch experimental analysis



4.3.7 Service applications and intended users

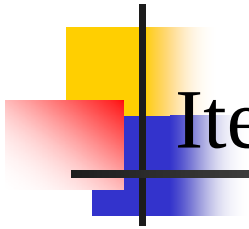
Service applications

1. Personal & business visual communications
2. Simple information retrieval from the net

Intended users

1. General public
2. Business users

4.3.8 Hardware implementation



Items	Hardware
Sensor/Actuator	Microphone
Module	Receiver, LCD
Processing	Voice codec
Module	Speech processor
	Image processor
UNI	GSM wireless interface (22.8 kbit/s)

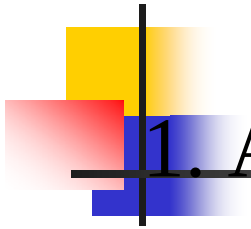
4.4 Gesture-phone

http://www.zmp.co.jp/html/shop_p2.html

Calling party

Called party's gesture is reconstructed by the robotics

4.4.1 Gesture-Phone: What is it?

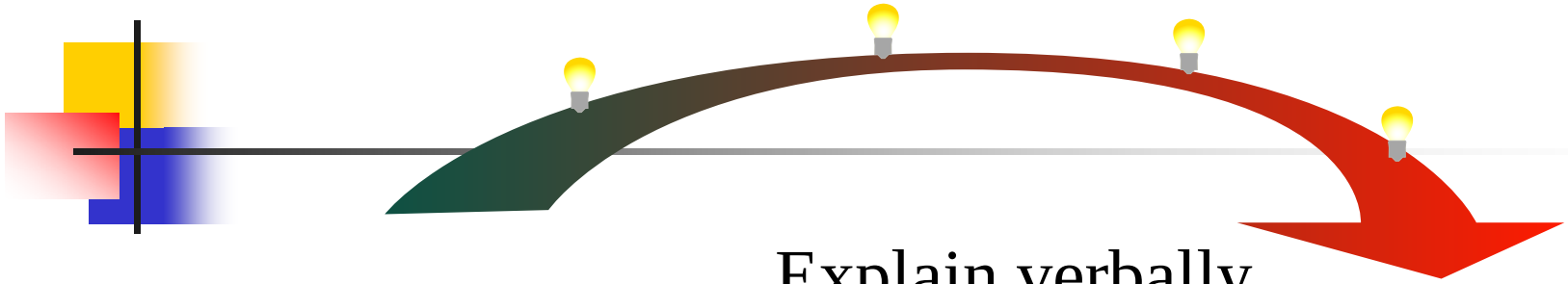


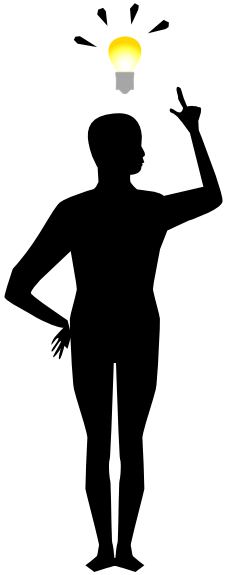
1. A new concept for human to human telecommunication terminal.

2. It transmits the non-verbal message in communication such as gestures, facial expressions and body postures.

3. Motions of the user from one side is reconstructed at the other side by humanoid of robotics.

4.4.2 Face to Face Communication



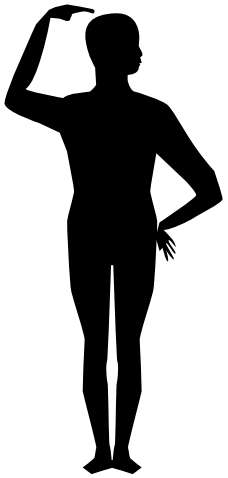


Explain verbally

&

Non-verbally

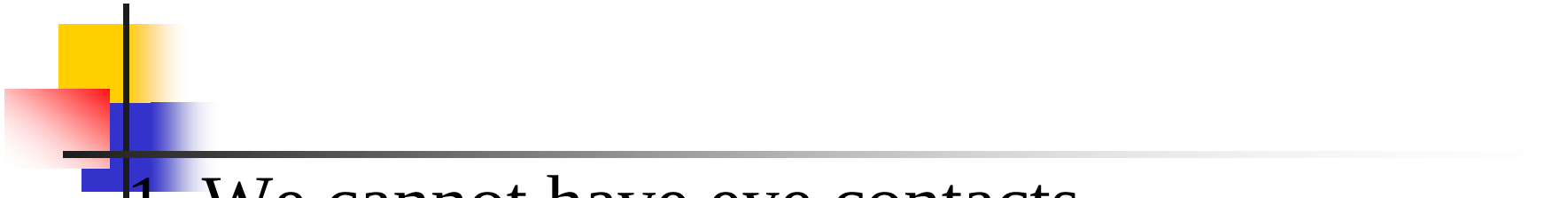
? Yes!



Making eye contact, gestures
- limbs, body, head, shoulders

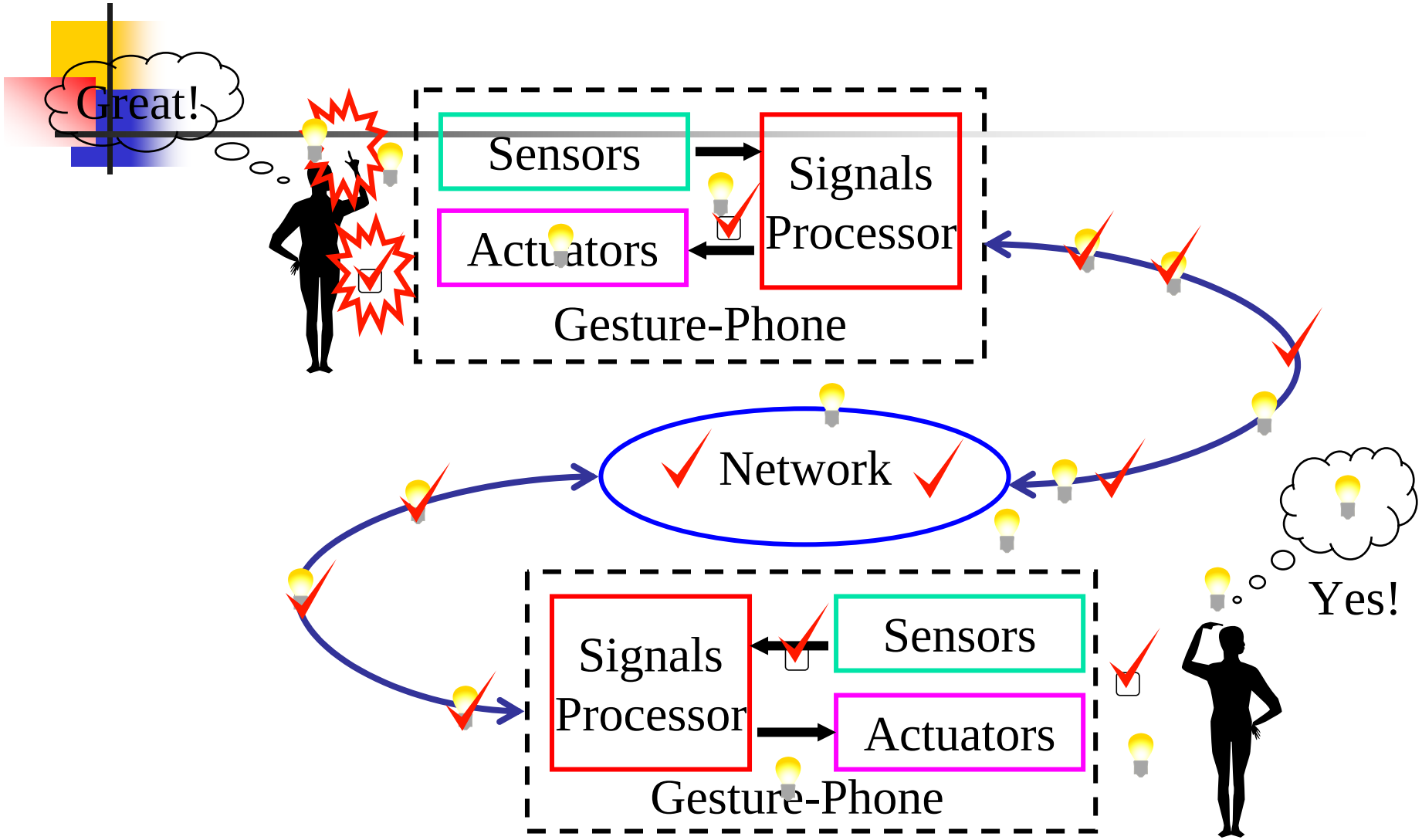
Using illustrations, etc

4.4.3 When distance is the Barrier...

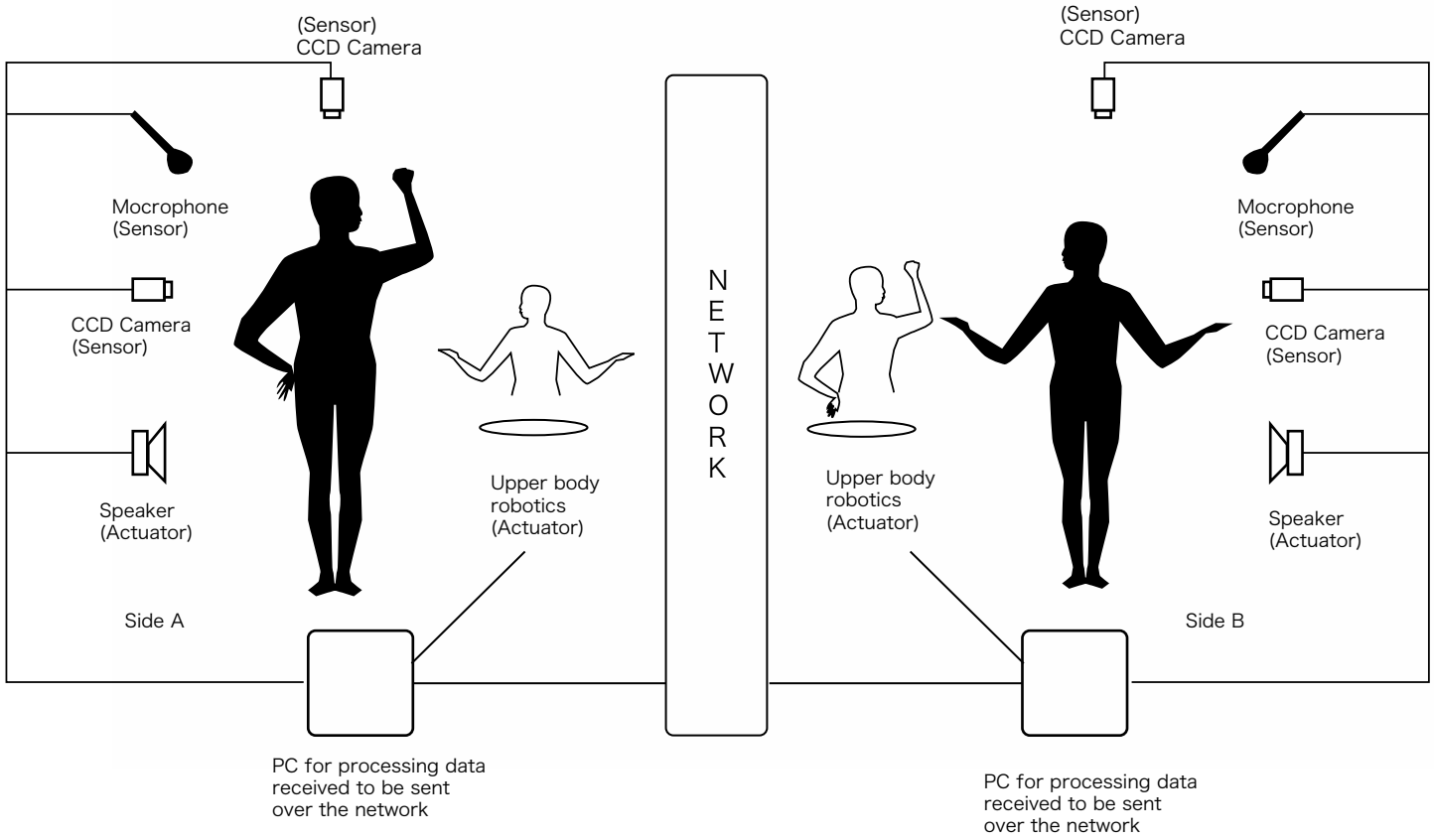


1. We cannot have eye contacts
2. We cannot see what the other person is doing
3. We cannot hear what the other person is saying

4.4.4 Gesture-Phone concept: How?



4.4.5 Example implementation

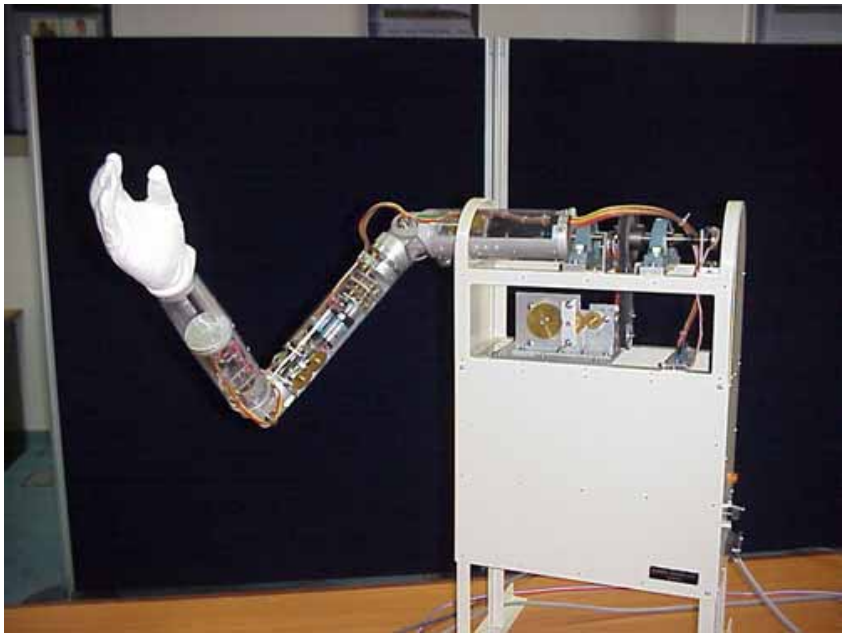


4.4.6 Hardware implementation of the arm motion transmission system

Items	Hardware
Sensor/Actuator	CCD camera, Microphone/Robotic
Module	Arm, Speaker
Processing Module	Voice codec, image processor
UNI	Basic rate ISDN or 10BaseT

4.4.7 Sensor & Actuator

- Sensor - CCD Cameras
- Actuator - Robotic Arm



4.4.8 Focus on Gesturephone System research work

1. Network bandwidth: narrow bandwidth is expected

2. Effect of network delay: maximum allowable delay should be determined

3. Safety: small, safe, no hazard to anyone, flexible to external forces

4. Motion speed: safe maximum speed should be determined

5. Tangibility: natural sense of touch

4.4.9 Service applications and intended users

Service applications

- Personal communications
- Communications for the handicapped
- Hand work transmission
- Distant learning

Intended users

- Business
- General public

4.4.10 Evaluation results

- Network delay < 273ms.
- Low bandwidth is required for gesture transmission.
- There is a potential room for inclusion of gesture in telecommunication.
- Size of actuator does not have to be the same size as the human arm.
- Tracking accuracy is not paramount for satisfactory gesture reconstruction

4.4.11 Future work

1. Protocol development for sending gestures over the network - synchronization issues
2. Noiseless robotic actuators research
3. Flexible humanoid robotics research
4. Sensor alternatives for tracking human gestures and postures

4.5 Our Final Target

To develop telecommunication systems by which you can fall in love*!!*

4.6 E-learning

4.6.1 Teaching/Learning materials

4.6.2 Book/IT as teaching/learning material

4.6.3 MMU has been utilizing courses on line from the beginning

4.6.4 MKB-e would provide you a solution

4.6.5 New HCI introduction

4.6.6 MKBe-Learning System

4.6.7 My intended solution

4.6.1 Teaching/Learning materials

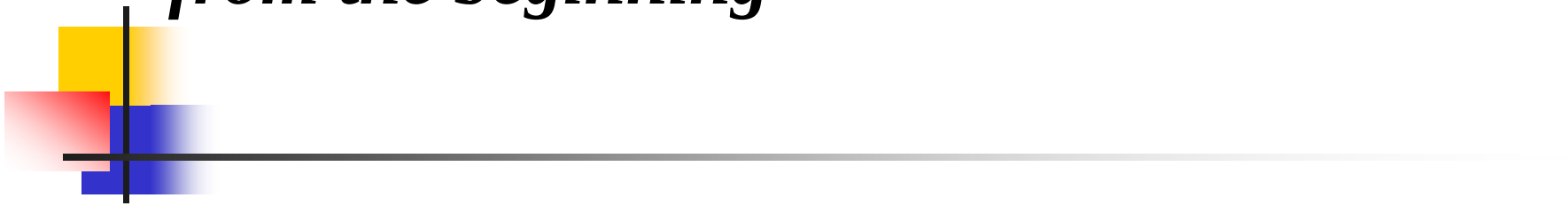
15c-20c: Paper text book (Due to the letterpress printing by Mr. Johannes Gutenberg)

End of 20c-now: IT technologies join as a player, but still we are not utilizing the technologies in a full fledged manner.

4.6.2 Book/IT as teaching/learning material

	Book	IT
portability	excellent	improving
price	cheap	expensive
media	text, tables, figures	sound, animation, video clips to be added
publishing	not so frequently	easy to revise
interactivity	none	expected, limited
future	still necessary	innovative& challenging

4.6.3 MMU has been utilizing courses on line from the beginning



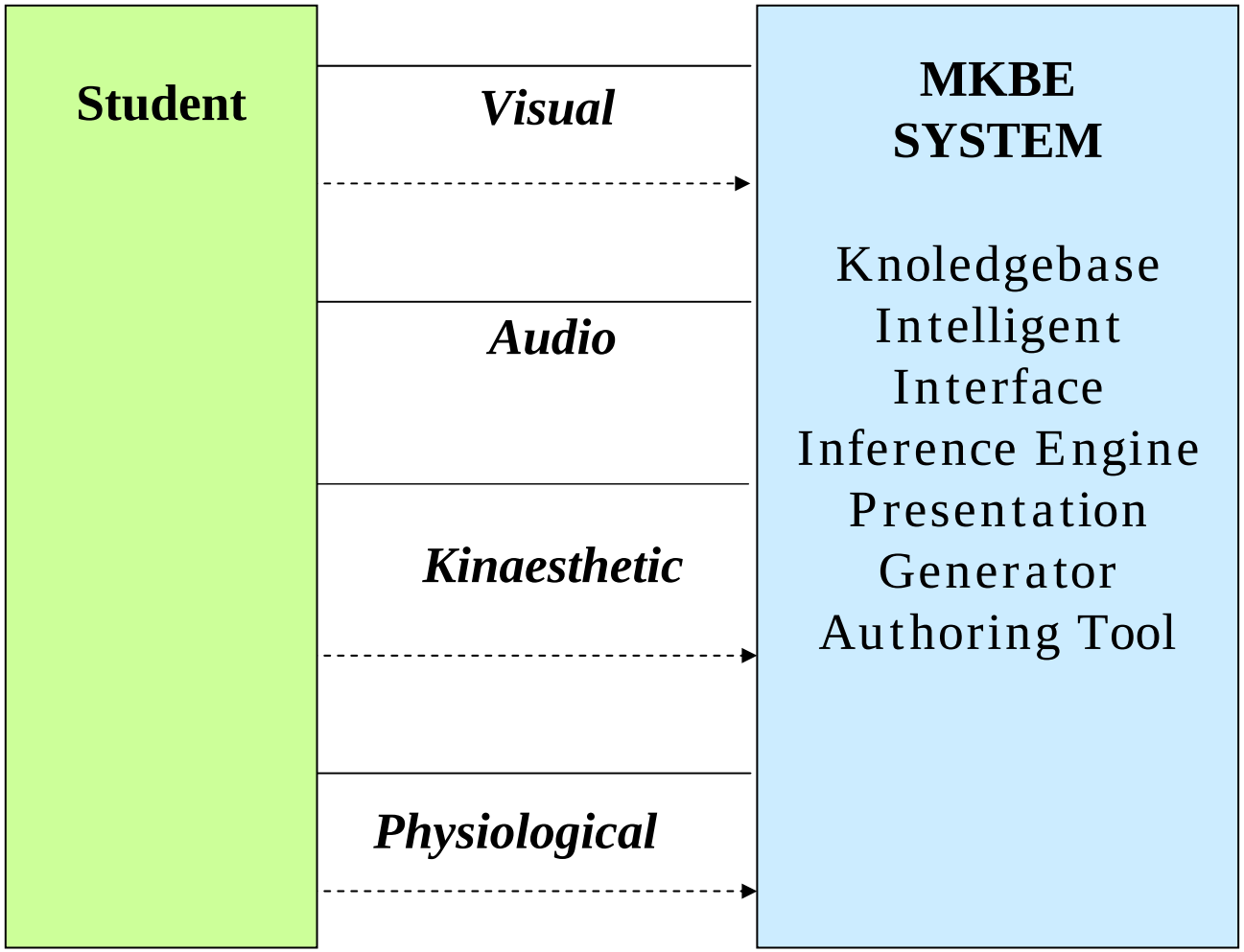
But, we have many issues to improve;

- Full utilization of ICT
- Full utilization of multimedia
- Interactivity
- Efficient contents development
- Standardization of knowledge

4.6.4 MKB-e would provide you a solution

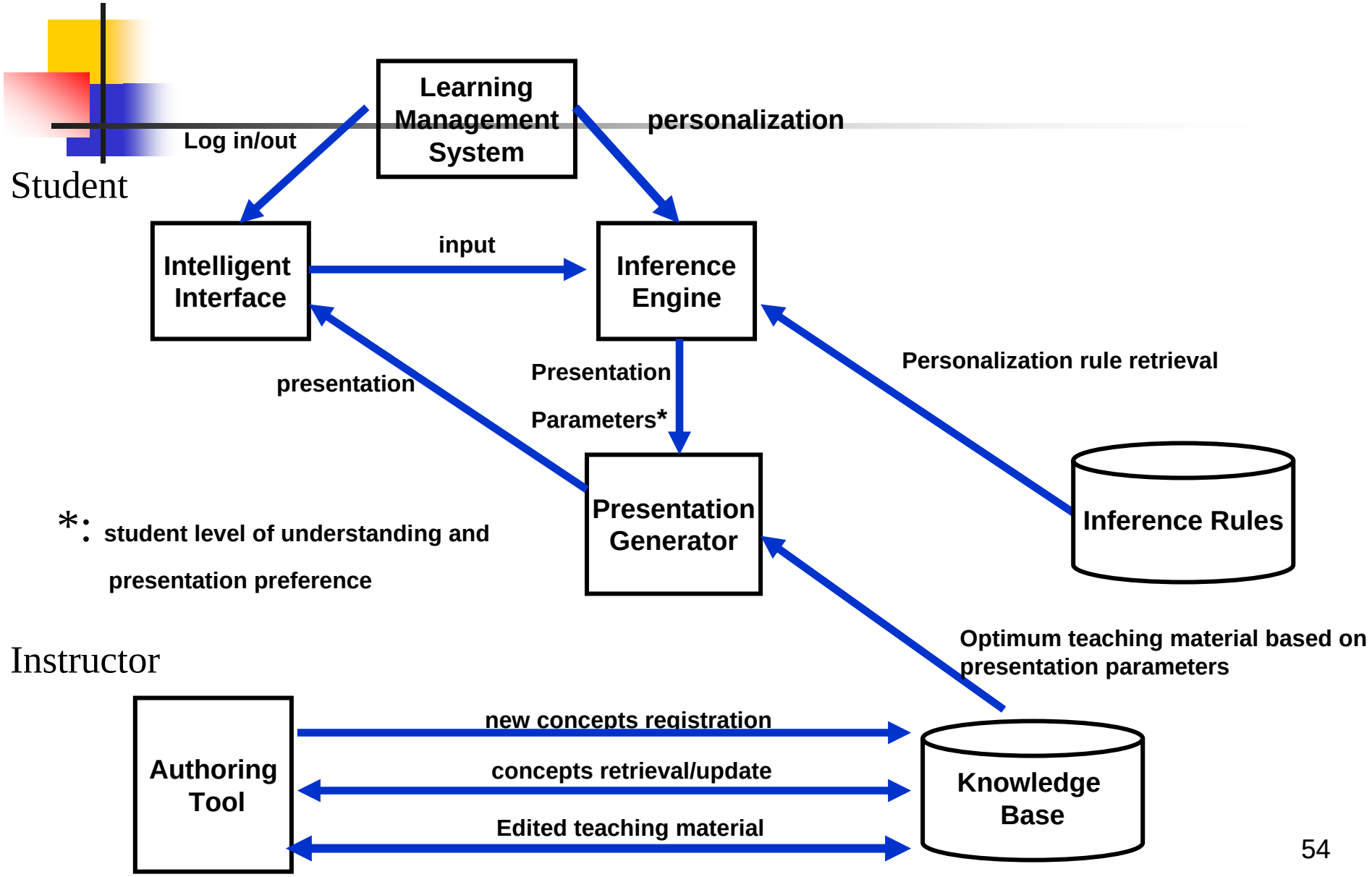
1. Advanced user friendly HCI
2. Universally standardized knowledge circulation
3. Cost effective teaching material production

4.6.5 New HCI introduction



4.6.6 MKBe-Learning System

MMU



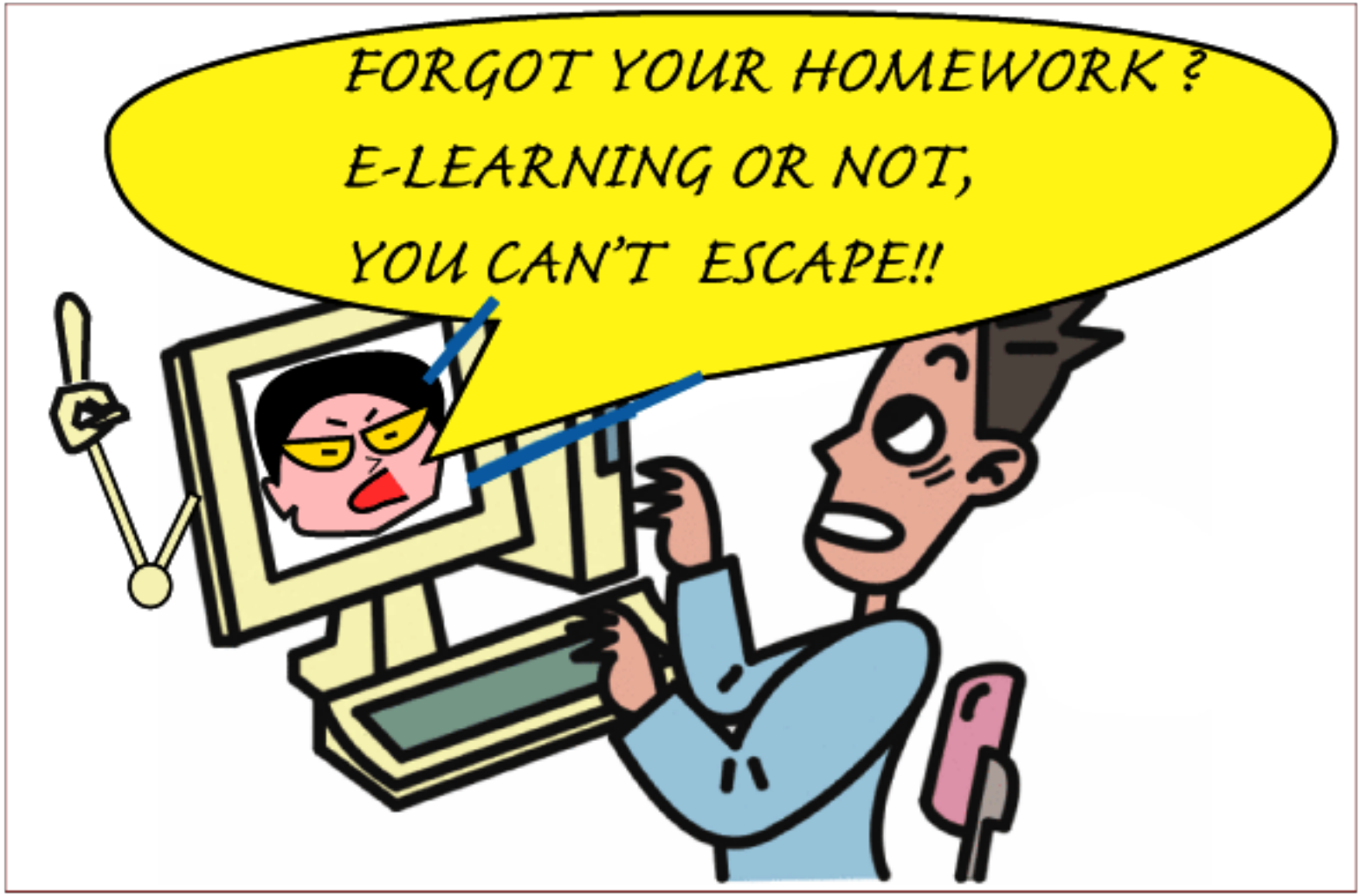
Specific features

1. **Knowledge Base**: To be developed by Object Oriented approach. The OO model is composed of concept, characteristics and media.
2. **Authoring Tool:** To provide automated instructional design to train the instructors to be instructional designers and to provide customisable templates to train the instructors to be web developers.
3. **Intelligent Interface:** To collect student's learning behavior data such as facial expressions, mouse handling.
4. **Inference Engine:** To classify student as weak, average and good based on the data sent from intelligent interface.

Specific features

5. **Presentation Generator:** To provide most appropriate teaching contents to the students based on the classifications done by inference engine.
6. **Learning Management System:** To manage student registration and student learning in the system.

4.6.7 My intended solution



Thank you for your attention!