問題発見型／解決型学習(FBL/PBL) テーマ提案（学生募集内容）

Topic name	Foreign Language Education++
Teacher	Design Unit Specific Assistant Professor NITSCHKE, CHRISTIAN
Collaborators	
Topic background	The field of IT is rapidly changing from the days when computers were professional and complex devices operated by experts. Key factors of this development are: • increasing processing power at decreasing size and price; • increasing I/O capabilities through sensors (touch, camera, microphone, GPS, gyroscope, accelerometer, etc.), novel displays (3D, head-mounted, etc.) and communication channels (3G/LTE, WIFI, NFC/Bluetooth, etc.); and • increasing number and appearance of computing devices. This leads to a paradigm change from desktop to ubiquitous computing (using any device, in any location, in any format) and ambient intelligence in electronic environments that are sensitive and responsive to the presence of people. As IT enters all areas of life to solve a broad range of problems, the field itself becomes highly interdisciplinary. Designing future technology requires not only excellent engineering but more and more knowledge of the application domain and usage scenarios. Regarding this, Kyoto University's Collaborative Graduate Program in Design provides an ideal opportunity to learn how to identify and solve such complex problems with a diverse team of professionals. With the VR (virtual reality) system at KRP:  we have an ideal environment to study, design and experiment with new technology and user interaction concepts to create an immersive simulated reality.

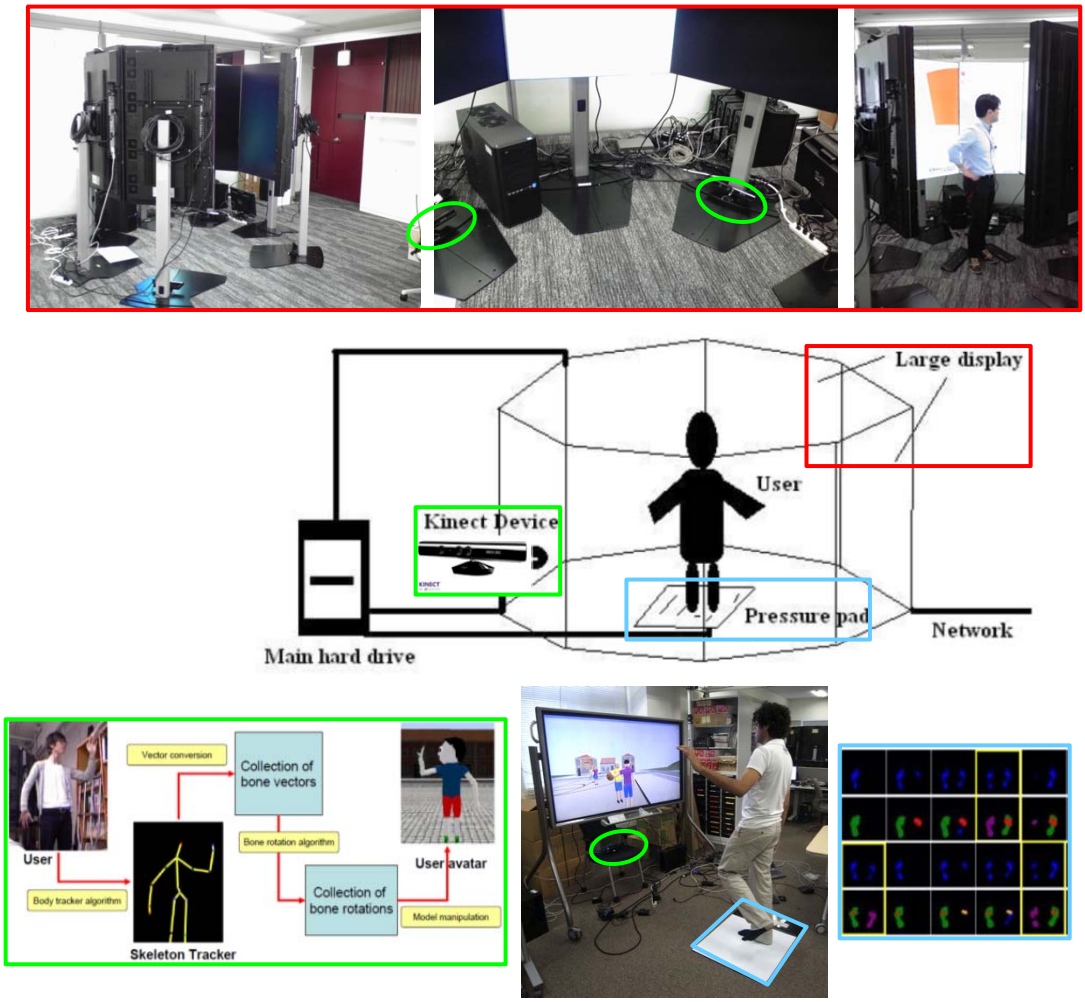


Figure 2: Virtual Interactive Spatially Immersive Environment (VISIE) with 360° panoramic display, Kinect body motion capturing, and pressure pad walk detection, to control a virtual avatar.

Its key features are:

- 8 large 1366x768 displays that form a 360° panoramic 6144x1366 display;
- 4 Microsoft Kinect cameras to capture human body pose, 3D model and sound from different angles;
- 1 pressure-sensitive foot-mat to recognize actions for walking/running, turning around, etc.;
- 1 Seeing Machines faceLAB system to capture face and eye movements for interaction and emotion understanding;
- 1 TEAC Polymate medical bio-measurement system including various sensors (pulse wave, respiratory, temperature, SpO_2, etc.) to estimate body state (emotion, stress, tiredness, etc.) from physiological signals.

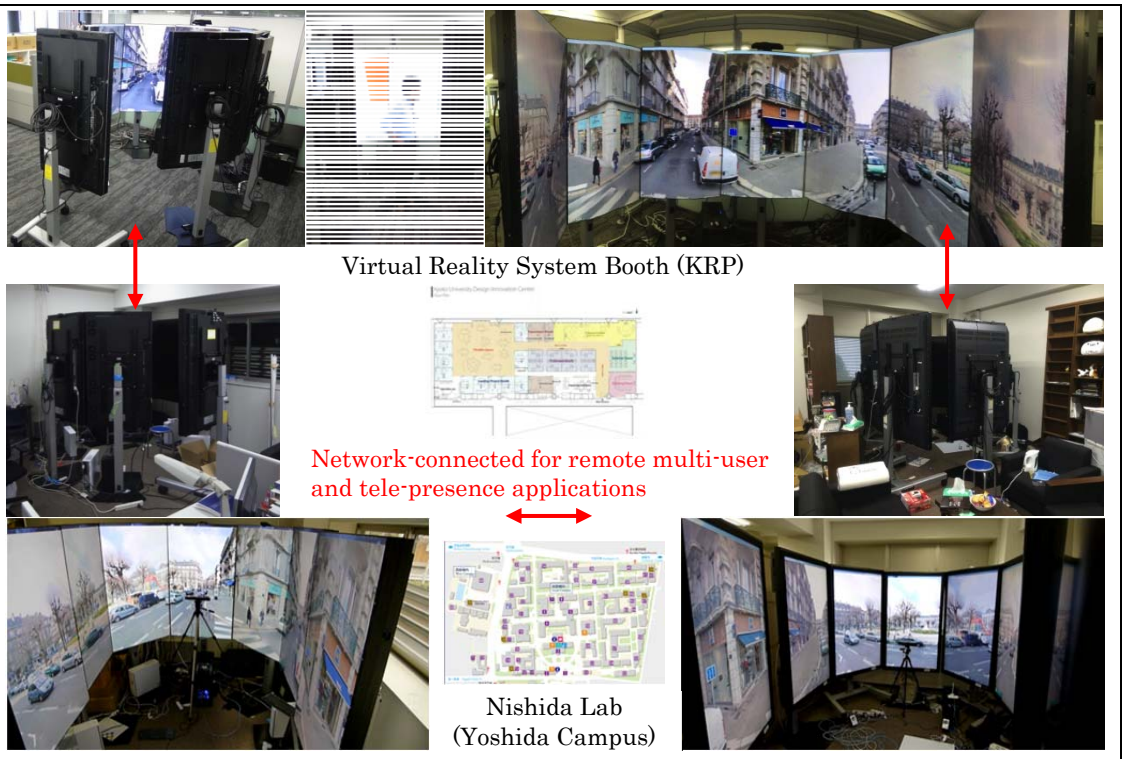


Figure 3: The ICIE at KRP and two similar setups at Yoshida campus can be operated in parallel for remote multi-user and tele-presence applications, such as remote meetings.

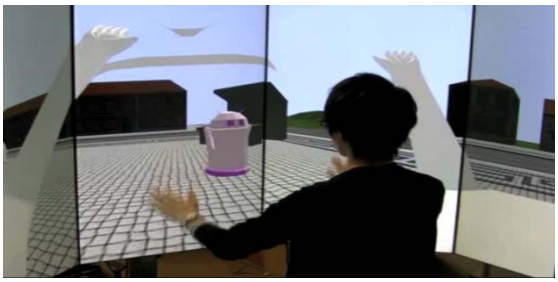
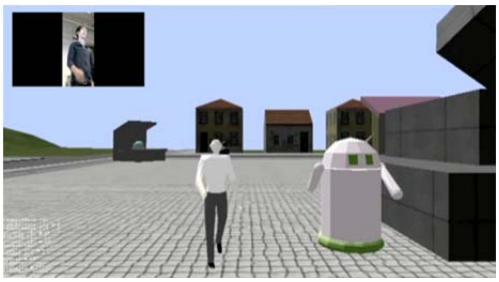
Figure 4: The shows participants at the two ICIE setups at Yoshida campus, in a live demonstration of remote meeting and joint guided tour to Arashiyama, conducted at the visit of Prof. Makoto Nagao (http://ja.wikipedia.org/wiki/長尾真), the former President of Kyoto University and Director of the National Diet Library of Japan, to KRP at December 16, 2013. In this system, the video of remote parties is captured, segmented, network-transmitted and geometrical-consistently displayed to allow for joint attention and referencing. Access https://youtu.be/GD4XlH_nOyo for the video of the demonstration.

To get a better understanding of the immersive environment that we will use in this course, please visit the Youtube-channel of Nishida Laboratory:
https://www.youtube.com/user/KyotoUniNishidaLab,
where you can find demonstrations on natural interaction in virtual environments and research in communication analysis between humans and avatars. Especially recommended are the following examples:

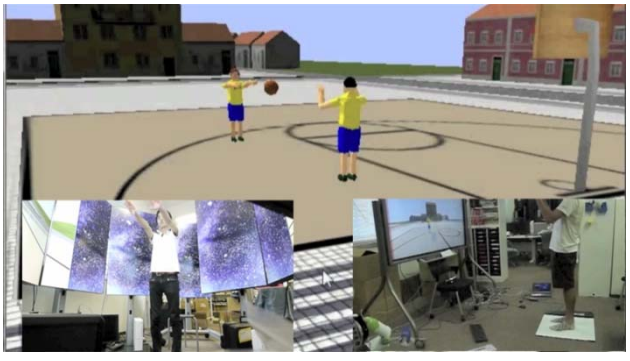
1. **Navigation and interaction in remote real environments** – in a 3D-reconstructed model of Yoshida campus (https://youtu.be/68UrJv65HvY) or at any place in the world supported by Google Street View (https://youtu.be/V-9SKpcMrzk). An extension of the latter system


allows three participants, located at the three ICIE installations at KRP and Yoshida campus, to gather in a shared remote environment for a real-time meeting supporting communication and interaction. This can provide the basis to implement and study education tasks (https://youtu.be/GD4XlH_nOyo) (Figures 3, 4).

2. **Interaction and navigation in virtual environments.**
A demo of our TA Divesh's Master course research (https://youtu.be/_oNXTq5LtVk)

demonstrates how a virtual environment is visualized on the 360° panoramic display, how the user controls the avatar's walking motion with the pressure-sensitive foot-mat and the avatar's body motion using Kinect motion capture, and how the system supports multiple users in different environments over a network. Another video (https://youtu.be/ZtjSRjHBgUs) demonstrates a first prototype of the "Virtual Basketball"



environment to conduct a part of Divesh's Doctors course research on understanding human-human non-verbal communication in a virtual environment, with the aim to improve human-avatar communication. The video shows picture-in-picture: the virtual environment, and two remote users controlling their player avatars to dribble, pass, and shoot the ball.

Overview	In this PBL, we want to address the problem of foreign language (and culture) education. As the philosopher Wittgenstein suggests, the meaning of language is defined by its use. Regarding the foreign language learning environment, it implies that the learner needs to learn a language as an association between the linguistic expressions and the situations in which they are used. Unfortunately, the common educational practice lacks the situation and usage parts. Our solution approach should be technical, inspired by the potential and challenges of technologic progress. This also contributes to the broader problem, of defining how technology (that will certainly come) should be used in a way to improve individual lives and future society. Therefore, the '++' in the PBL title stands for the technical approach and a future/next step in foreign language education (following the notation of incrementation in several programming languages). It further expresses a double value for creatively applying technology and solving a practical real-world problem. Specifically, we want to analyze if and how immersive environments can be of a merit. For example, to connect people at different places in the world through remote meeting, to create situation contexts through simulation, to provide more effective education planning and quality measuring using data from various sensors, and to increase motivation through richness and effectiveness. The problem provides potential for an equal contribution of different disciplines. Depending on the participants, we want to elaborate a problem definition and solution strategy, where everyone can bring in their expertise. For example: • Architects may want to think about where and how such technology could be found in the future, how education context could look like, where education situations may happen. • Education experts may bring in theoretic background behind current education, and discuss improvements for the future, considering the expected development of education needs, situations and tools. What is beneficial to increase the efficiency of education, in a broad sense, including learning rate, applicability, longevity, learner/teacher satisfaction, etc. How about life-long learning and situations beyond school education? • Engineers may think about the technical realization, discuss current limitations and their realistic and unrealistic expectation on future development. • Medical experts and psychologists may bring in their knowledge to design ways on how to assess the situation using biomedical sensors (measuring for example physiological/mental state, cognitive load and stress, cultural background, character and behavior) and how this can give a feedback and improve the education process. The PBL will cover the following four phases: <u>1. Technical introduction</u> It is important to understand the potential and challenges behind the technology in order to start designing something new and, therefore, we want to study the available technology in the VR booth through lectures and interactive tryouts. <u>2. Application scenario design</u> Based on this, we want to have a general discussion on the feasibility and design issues related to potential application scenarios, such as

	• Education: teaching, training and testing of skills; • Work: remote collaboration; simulation and modeling; control of machines and robots; • Life support: for elderly, disabled; • Entertainment: games, remote navigation (walk, drive, flight simulator); • Medicine: remote consultation and assessment from sensor data; • Research: computational analysis of multi-modal sensor data in physiology, psychology, behavior science, social science, etc. This will design a deeper and bigger aspect of the technology and go beyond the application of current computing technology. 3. Foreign language learning problem We will analyze the current situation of foreign language education in Japan, identify general problems and develop improvement strategies. Continuing in the scope of this PBL, we want to assess the potential of situation-based learning, create a problem definition and design a technically feasible solution concept. The main focus is to develop a big idea emerging from the different disciplines. Finally, we want to create a simple specific realization of a situation-based communication example or particular components that are most interesting and important to the participants. 4. Retrospection The realized problem solution is only a part of the course. The other part is to experience the process of interdisciplinary designing a complex technical system. This final phase of the course will contain two parts: First, we want to evaluate the foreign language learning problem and solution approach, especially discussing limitations of the technology and issues of the interdisciplinary approach. Then, we want to become more general and expand the discussion towards the whole course, and ask what lessons we learn for the future.
Place	KRP Building #9, Room 506, Flexible Space / Virtual Reality System Booth
Conditions for participation	Nothing in particular. Remarks: 1. Background and skills The goal of last spring term's PBL proposal was to develop a sophisticated multi-player basketball game. After meeting and discussing with students, it turned out to be difficult to focus only on the software engineering and programming aspect. Therefore, the goal of this PBL is broader, aiming to solve a "real-world" problem in education and identify questions and design solutions related to technology. The focus now lies on problem solving in an interdisciplinary environment. 2. English ability The course will be held in English. However, interested participants are especially encouraged to not reject this course because of English skills. The level and usage of English will be flexibly adjusted based on the level of the participants, and will not count for grading the course. The aim is to create a comfortable atmosphere for the use of English, to enable the access of globally available resources.
Number of participants	Min: 3 Max: 8
Application	May 2 (Friday)

deadline	
Target participants	Anyone motivated and interested in the topic, especially • undergraduate, graduate students, members of Kyoto University; • undergraduate, graduate students, members of universities and institutes; • engineers, researchers, general members of companies. However, if the number of applicants exceeds the maximum, priority will be given to Design School students.
How to apply	(To program students and candidates: follow the instruction at the orientation) By email, including the following: To: christian.nitschke@i.kyoto-u.ac.jp CC: fblpbl-application@design.kyoto-u.ac.jp Subject: [FBL/PBL 参加申込] Foreign Language Education++ Mail body text: name, organization, position/school year, email address, web page, background knowledge and field of specialization, course topic name, motivation for course application, and other information
Decision of participants	By email, until May 9 (Friday)
Design theories and techniques for problem analysis and solution finding	Hard skills: • Understanding potential and usage of important computation technology • Design, implementation and evaluation of complex hardware systems • Practical implementation Soft skills: • Team work and interdisciplinary collaboration • Presentation and discussion • English language and inter-cultural ability (see “Conditions for participation”)
Method for studying theories and techniques	The course will use the technology available at the virtual reality system booth (see “Topic background”), and comprise: • Lectures on technologies, Mixed and Virtual Reality (MR/VR) world design and research • Problem and solution finding, discussion • Design and implementation of a prototype or a subproblem • Preparation of results for webpage publication • Final report and presentation The participants will work together in teams.
Method for publishing the results	We will create and maintain a webpage that contains: overview of the course, problems and solution methods, study progress and results.
Performance evaluation method	• Comprehension of topic, theories and methods: 50% (observation and report) • Quality of problem finding and solution design: 20% (observation and report) • Class activity, contribution in group work, learning beyond expertise: 30% (observation) Attendance requirement: 80% of class time
Special remarks	Project outcome: • Each participant will independently create a final report (2-3 A4 pages) that summarizes solved problems, progress and results. • Results and materials (presentation/discussion, source code, demo material, documentation) will be made accessible through the webpage and are well prepared to ensure the preservation

	of the knowledge and continuity of the course. Future plan: Building on the results of this course, we plan to offer a more research-oriented continuation course next semester (PBL or Leading Project). Current participants should especially consider joining that course to study about publication and presentation of their work. The focus is the following: • Understanding research and publication process • Survey of related research areas and analysis of publication possibilities • Improvement of previous results with goal on publication • Design and implementation of experimental evaluation • Publication of a research paper including the participants names

実施計画

(The class schedule will be decided based on the participant availability before the first meeting.)

Unit	Schedule	Place	Content
1	Mid May	KRP	Introduction lecture • Motivation and aim of the project • Outline and organization of the course • Demonstration of virtual reality system at KRP
			Technology introduction
2-5			Lectures, tutorials, tryouts on technology • Multi-display setup, (game) programming with Unity • Kinect and pressure-pad • faceLAB and Polymate bio-sensors
	Beginning June		**Application scenario design**
6-7			Development of application concepts • Analyze potential for different application areas • Design concept and plan for selected application • Presentation of results
			Foreign language learning problem
8			Analyze topic and situation • Identify current problems • Identify potential future problems
9	End June		Development of general solution strategies
10-12			Design of problem and solution regarding situation-based learning with immersive environments • Development of general concept • Practical implementation of subproblem • Creation of documentation material (videos, screenshots, usage documentation, etc.)
	Beginning July		**Retrospection**
13			Foreign language learning problem • Limitations of technology • Issues in interdisciplinary approach and solution

14			Whole course • Evaluation of course expectations and results • Lessons to learn for the future
15			• Documentation of results • Finalization of materials and upload to webpage • Submission of project reports
			Final presentation

※KRP: デザインイノベーション拠点（京都リサーチパーク 9 号館 5 階）