Construction of an Automated High-Definition Remote Lecture System Connecting 18 National Universities in Japan

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Agenda

• Background
• Requirements of new system
• Design and construction
  – Device selection
  – Overview of a system
  – Reservation Management System
  – Monitoring remote equipment
• Knowledge with use of the system for 2 years
• Other using of a system
• Conclusion
• Beforetime, most Japanese universities have performed a remote lecture using SCS (Space Collaboration System)
  – SCS was used satellite communications and SCS has been managed by NIME since around 1997
• We performed remote lectures connected all National United Graduate Schools of Agricultural Sciences using SCS in June and November every year.
  – There are 6 National United Graduate Schools of Agricultural Sciences in Japan. Each of them consists of 2-4 national universities, and the total number of the constituent university is 18.
Connecting 18 National Universities in JAPAN

- Obihiro University of Agriculture and Veterinary Medicine
- The United Graduate School of Agricultural Science, Iwate University
- The United Graduate School of Agricultural Science, Gifu University
- Hirosaki University
- Iwate University
- Yamagata University
- The United Graduate School of Agricultural Science, Iwate University
- Shimane University
- Tottori University
- The United Graduate School of Agricultural Science, Tottori University
- Yamaguchi University
- Saga University
- Shizuoka University
- The United Graduate School of Agricultural Science, Ehime University
- Shizuoka University
- Kochi University
- Ehime University
- Tokyo University of Agriculture and Technology
- The United Graduate School of Agricultural Science, Tokyo University of Agriculture and Technology
- University of Ryukyu
- Kagoshima University
- Kagawa University
- The United Graduate School of Agricultural Science, Kagoshima University
• SCS has Some problems
  – A satellite connection fee was expensive.
  – We had to make reservations by one week to use SCS.
  – In 2008, trouble of machinery by deterioration happened many times, and a satellite line linked down many times in SCS.

• Next system of SCS was necessary. Thus we decided to build a new system. but... we don’t have much budget.
Requirements of New System

- Multi-directional communications that connected many sites at the same time
- Simple machinery operation
- Interoperability with the other videoconference systems
- Supported two screens with high-definition
- Provide high quality videos and sounds
- Many universities (more than 18 universities) can join same lecture
• MCU (Multipoint Control Unit)
  – To connect plural videoconference devices at the same time, MCU are necessary.
  – We use outside device as MCU to connect 23 sites in 18 universities.
    • MCU inside of a videoconference device, does not accept enough connections.
  – Polycom RMX2000-MPM+160
    • accept connection at 40 high-definition videoconference devices at same time
Using network is SINET3

- In a videoconference that used the Internet, a stable network is necessary.
- In Japan, there is a backbone of academic network called SINET3 (The Science Information Network 3).
  - SINET3 is renewed to SINET4.
- Since many of Japanese universities are connected with SINET.
Design and Construction – 3

- **Videoconference terminal**
  - Many universities and companies have a videoconference terminal which is based on H.323 and SIP made by Polycom, Tandberg or Sony.
  - Interoperability is required
  - It is required to display high quality image of materials or documents at remote side. (HD: High-Definition)
  
  - Polycom HDX-8006XLP
    - Supported HD video streams: simultaneously two HD video streams, a camera and a PC (documents or material) image
    - Interoperability with other HD and SD videoconference system made by other companies
    - Support 720p/60fps, 1080p/30fps video and stereo 22KHz sound.
Design and Construction – 4

• Buy and installed videoconference devices only
  – Equipment operations are difficult and system users are concerned.
  – It is difficult to manage videoconference terminal because wireless remote commander of equipment has dozens of buttons.
  – It is pushed the wireless remote commander of equipment carelessly, there are troubles that setting is changed, takes a sound mute and videoconferencing is finished.

• We design and construction the wireless touch panel and reservation system.
• **Wireless touch panel and reservation system**
  – we do not let you use the wireless remote controllers attached to equipment.
  – The reservation system eases operation of the devices by automation.
  – Wireless touch panel is used for operating a videoconference terminal, camera, and AV equipment (data projectors, large-sized monitors, a sound amplifier, matrix switcher, etc.) at the same time.

• **Control of the system**
  – Using AMX NI-3100 programmable system controller.
  – Ethernet connected
    • Can control and moniter by reservation system and remote side
Overview of the system equipment

Tokyo University of Agriculture and Technology

- Multipoint Control Unit (MCU)
- Recording Server
- Streaming Server
- System Management / Reservation Server

SINET3

Each University (node)

- Full-HD Monitors (or Data Projectors)
- HD Camera (Lecturer) (Room)
- HD Videoconference Terminal
- Web Camera
- Wireless Touch Panel
- Digital Mixier / Howling Suppressor / Echo-canceller
- Wireless Microphone
- Ceiling Microphone
- Tablet PC
- Power Amplifier
- Speakers
Reservation Management System

1. Input a reservation to the Web system.
2. Transmit the reservation.
3. Wake up nodes equipments before reservation time automatically.
4. Wake up and set equipments.
5. Create a Virtual Meeting room and transmit information of connection nodes.
6. Connect reservation nodes automatically.
7. Perform a Remote Lecture.

User

Reservation Management Server

MCU Administration server

Multipoint Control Unit (MCU)

Each node

NI-3100 System Controller

AV equipments

HDX-8006XLP

Only input a reservation through the web, then go to lecture room at the reservation time.
### Reservation System – Web Interface

#### Meeting Organizer

**Conference Management & Scheduling Software**

#### メインメニュー

- スケジュール
- 部会会議
- 企画列席

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#### 開催日時 *

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- 繰り返し設定
  - この予定は繰り返さない
  - 毎日
  - 毎週月
  - 毎月3日
  - 毎月第1月第3日

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#### 参加者 *

- 参加者選択
  - 帝京大学
  - 東京大学
  - 岩手大学
  - 岡田大学

#### レコーディング

- 純音しない

#### 会議の設定 レイアウト設定

""
Problems at Constructing the System

• Many problems are occurred in construction.
  – The remote connection could not be established easily at initial construction
    • Firewall setting is difference such as network ports, at some universities
      – H.239 protocol is shut down when old version Cisco’s PIX firewall is used
      – It is limited to use ports for controlling AMX’s system controller because it is used for network monitoring inside of universities.
    • Mistakes on prepared network wiring
    • Equipment configuration issues and so on.
  – Bug of equipment
    • HDX-8006XLP (videoconference codec) and RMX-2000MPM + 160 (MCU) are new products
      – The bug putting are not complete it is difficult to judge whether network setting causes the problem or bug of equipment itself.
Additional Design and Construction

- Extend some additional functions
  - Reservation time extension function
    - A notice announcement, “reservation end time comes soon”, and system outputs the announcement from a speaker automatically before five minutes in reservation end time.
    - When user selects the “Extend Meeting Time” on touch panel at one node, this function extends reservation time for 10 minutes.
  - Reconnection function
    - The connection of the videoconference is rarely breaking down by the state of the network.
    - And several times, because the circuit breaker of building was down, equipment in a node was not started automatically.
    - We designed reconnection function.
Reconnection function

1. Touch the reservation time request button by user
2. Search reservation information at the node
3. Return reservation information and virtual meeting room number
4. Display reservation information and reconnect button
5. Touch the reconnect button by user
6. Reconnect virtual meeting room then continue the lecture or meeting
• The system is already used.
  – At an opening ceremony on February 23, 2009, remote lectures were presented connected all nodes.
  – Lectures and meetings were held 2060 times with this system for 4 years (Feb, 2009 to Apr, 2013).
  – Used about 60 times for the briefing session of how to use the system and the test of the system.
  – There are about 2 lectures and meetings per day (excluding holidays).
Using Our System – 2

number of times

1月 2月 3月 4月 5月 6月 7月 8月 9月 10月 11月 12月

2009 2010 2011 2012 2013
Constructing system : Opening Ceremony

A meeting room / Touch panel Screen
• The extension function of reservation time was used about 10 times.
  – This function is used to gradually decrease.
  – Many reservations seemed to have reserved time that was longer than the meeting plan.
    • The average holding time of meetings and lectures was about 2 hours and 40 minutes, but the average meeting time was reserved for 2 hours and 50 minutes.
  – Many users have to shut down the system from touch panel before coming to the end time of booking.
Using Our System – 4

- Reconnection function was used about 20 times.
  - This function was used so that the network line to a node was unstable mainly when videoconference connection was down.
  - Very rare case: This feature was used to recover the connection when the system did not automatically start because turned off the circuit breaker for the building.
Other using of a system

• Helping other university: MCU was broken in other university. We supplied our system’s MCU function temporality.
  – MCU with redundancy is expensive. Therefore when a fault occurs, the MCU functions interoperable with other universities.

• Connect neighbor rooms
  – Installed this system to the neighbor rooms.
  – Connect rooms nearby using this system and create some virtual big room.
  – Several times a year, a virtual classroom can be created over 600 people participants to connect the several neighboring rooms, which are used in lectures and meetings.
Connect neighbor rooms and Create virtual big room
Conclusion

• We designed and constructed of a High-Definition videoconference system connecting 18 Japanese national universities.
  – Added to the node, the total node number is 36.
  – There are about 2 lectures and meetings per day.

• This system can reduce a burden of a user, because the user can use it with simple operation for reservation from Web, and a system starts automatically in reservation time and sets it.

• We designed an extension function of reservation time and a reconnection function, and we implemented these.

• This system is a beginning in Japan, as for the remote lecture using a high-definition picture connected Japanese universities from the north to the south.

• In the future, this system makes advantage of usage with high quality videos and sounds, and it is expected to use widely.
Acknowledgement

• We would like to thank Audio Visual Communications Ltd. (http://www.avc.co.jp/) for supporting construction this system.

• We want to thank 18 universities staff.