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# Online communication assistant system for deafblind person

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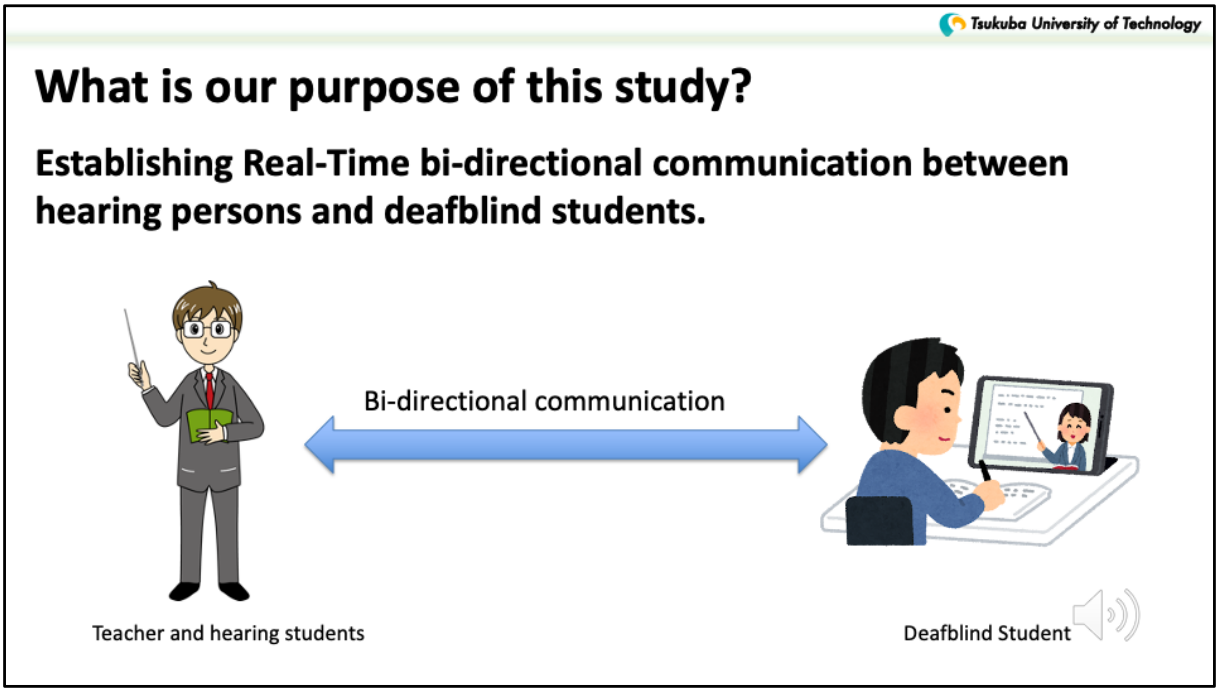
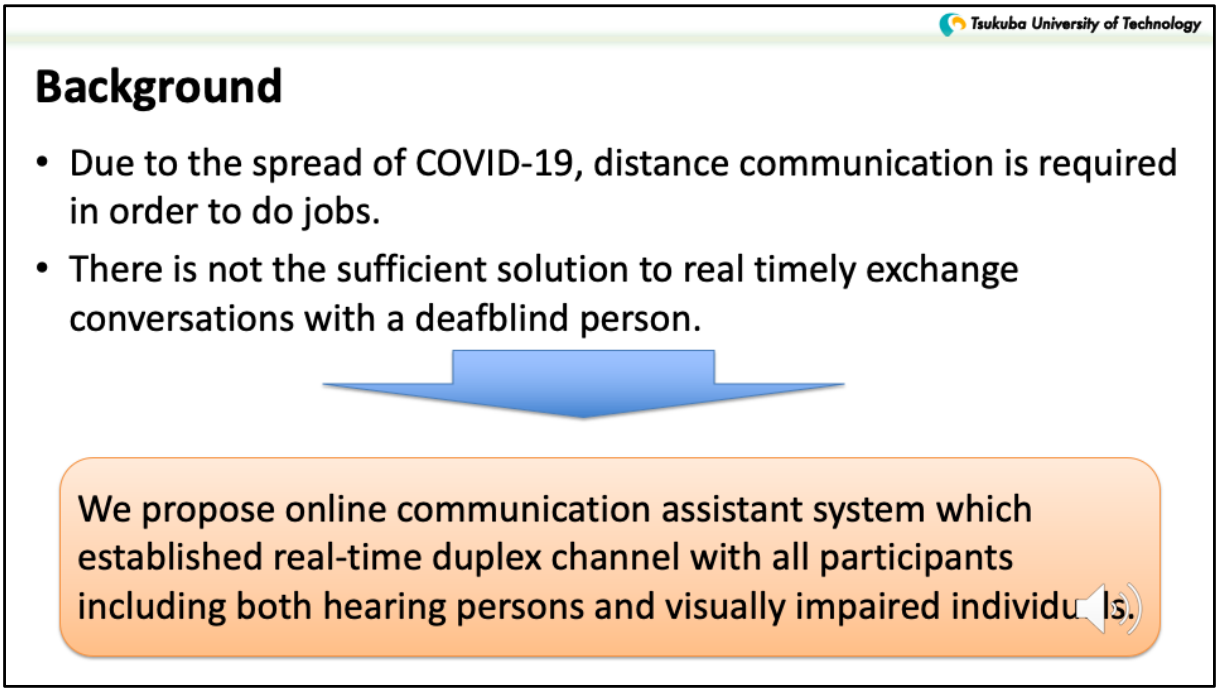
Hello everybody,
I am Junji Onishi from tsukubai university of technology in Japan.
Today, I'm going to talk about online communication assistant system for deafblind person.




Firstly, Let me talk about our purpose of this study.
This slide shows it.
What we want to do is a quite simple.
Well, We would like to establish real-time bi-directional communication between hearing persons and a deafblind student under online meetings each other.
What is the main communication problem under the online lecture?
It is that a teacher cannot know whether students can follow his talking or lecture materials and so on.
At least, teacher should avoid that students cannot keep up with the pace of his talking.
Also, it is the important that students can follow lecture materials provided by online system with a teacher's talking.
The main key point is 2 way communication between a teacher and students




This slide shows the background why we developed online assistant communication system for deafblind persons.
As you know, due to the spread of COVID-19, distance communication is required in order to do jobs.
However, there is not the sufficient solution to real timely exchange conversations with a deafblind person.
So, we propose online communication assistant system which established real-time duplex channel with all participants including both hearing persons and visually impaired individuals.

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# Assistive Technologies for blind persons

- **Technology to support reading and writing**
  - **Screen reader**
  - **Braille display**
  - **Portable computer**
  - **Tactile display**


This slide shows typical assistive technologies for blind persons.
There are 4 main solutions for blind persons to get information.
Screen reader
Braille display
Portable computer
Tactile display
These technologies convert visual medias to accessible medias for blind persons.

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## Assistive Technologies for deaf persons.

- **Communication methods**
  - **Hearing aids, cochlear implants, etc.**
  - **Summary writing**
  - **Speech reading**
  - **Sign language/Sign language interpreter**
- **Assistive technology**
  - **Summary writing using a PC**
  - **Information sharing service via network**
    - **Online sign language interpreter system**
    - **Distance summary interpreter system**
    - **Remote voice recognition captioning system**

This slide shows assistive technologies for deaf persons.
There are 4 communication support methods
There are typical solutions as you know.
Main solution is to convert to visual information from auditory information.
And its visual image should be clear and understandable what they mean to watch for them.

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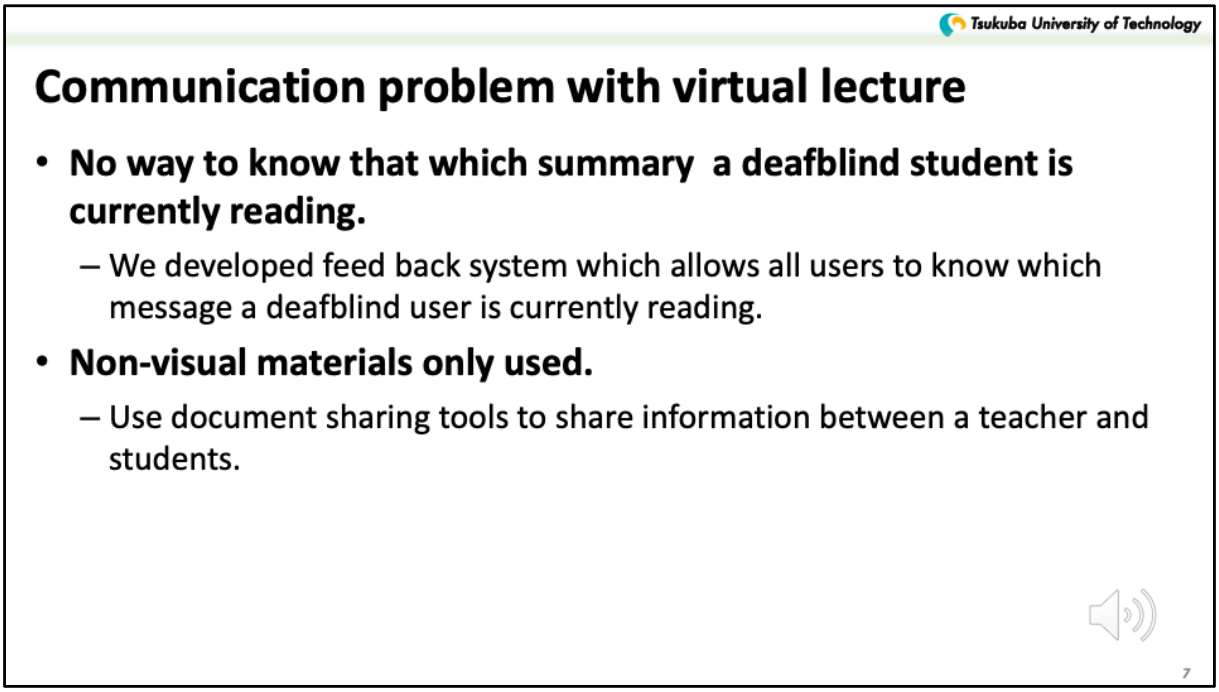
# Assistive Technologies for deafblind persons

- **Information exchange method**
  - Braille/Tactlile
  - Finger braille
  - Tactile signing
  - Writing on palm
  - Brushtalk
- **Assistive technology**
  - Currently, there are few dedicated devices and technologies.
  - In many cases, assistive technologies for visual and hearing impairments are used together.
- **Communication tools**
  - Blista Braille typewriter
  - Braille display
  - Finger braille devices

This slide shows assistive technologies for deafblind persons.
In most of cases, Information exchange method is based on tactile.
Also, there are few dedicated devices and technologies.
As you know, in many cases, these technologies for visual and hearing impairments are used together.
So, most of them are useful for individual guidance in order to communicate with a deafblind person.
However, in general, there are various problems in establishing real timely communication in an inclusive environment.




In this study, we would like to propose a system for casual and online communication between a large number of people which is inclusive of deafblind people as well as hearing people.
Though there are many problems to solve our purpose, we challenge to solve these two issues shown in this slide.

Our system was developed for the use of a Deafblind student who is currently studying in our university.
So, we wanted to create a system that would enable Deafblind students to be able to access information in real time, allowing them to study and gain information at the same speed and time together with other students.
We believe that our system will allow them to do so as efficiently as possible.

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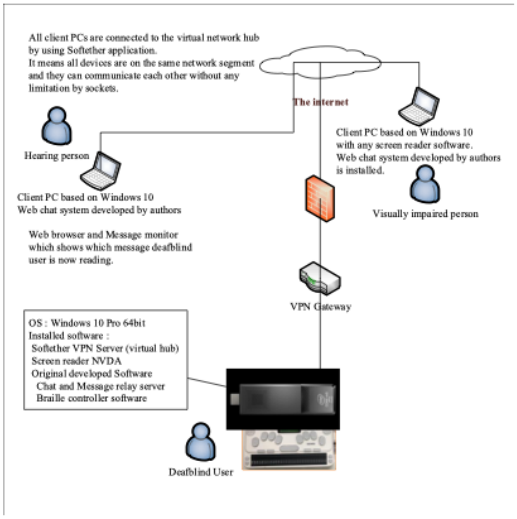
# Outline of our developed system




- **The proposed system consists of three components:**
  - a Web-based chat support application that supports conversation input,
  - a system that outputs conversation information to the deafblind user in Braille,
  - a server system (web application server) that relays all these important information.

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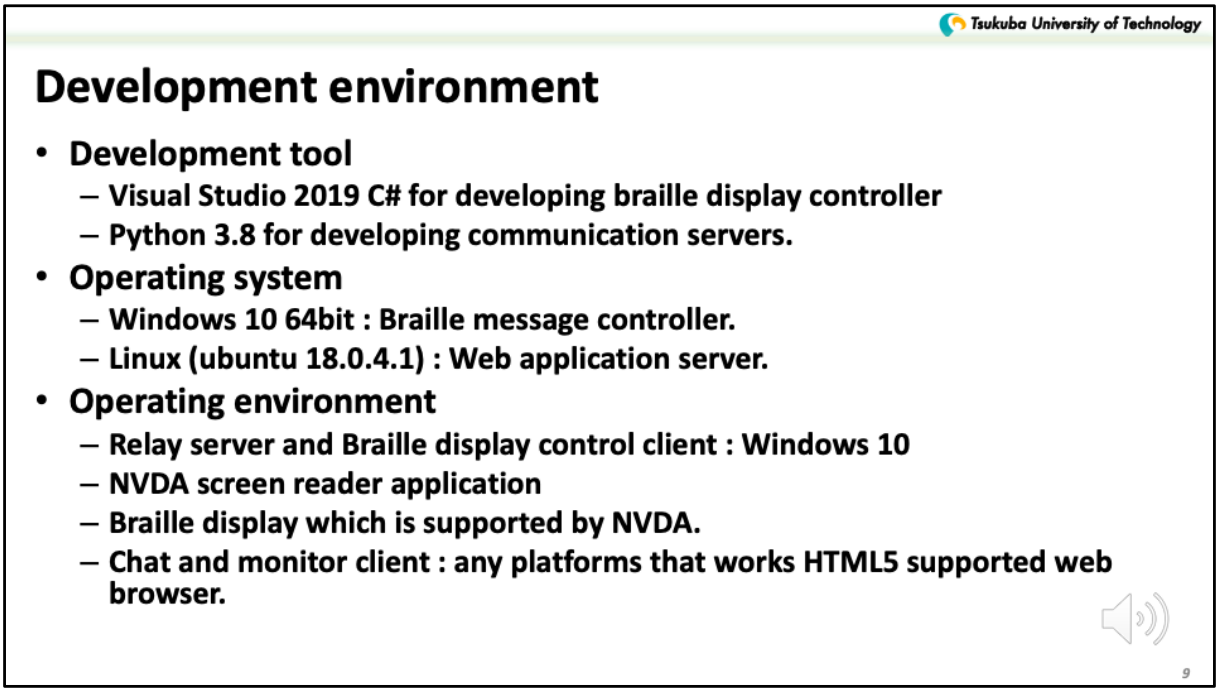
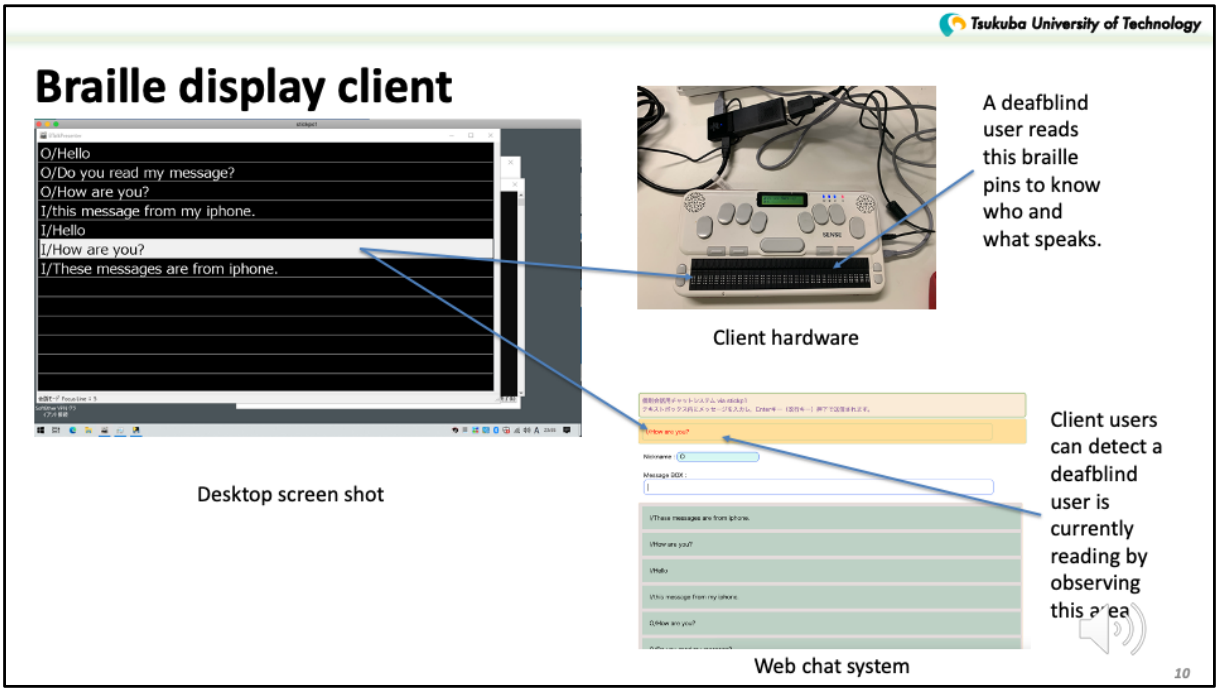
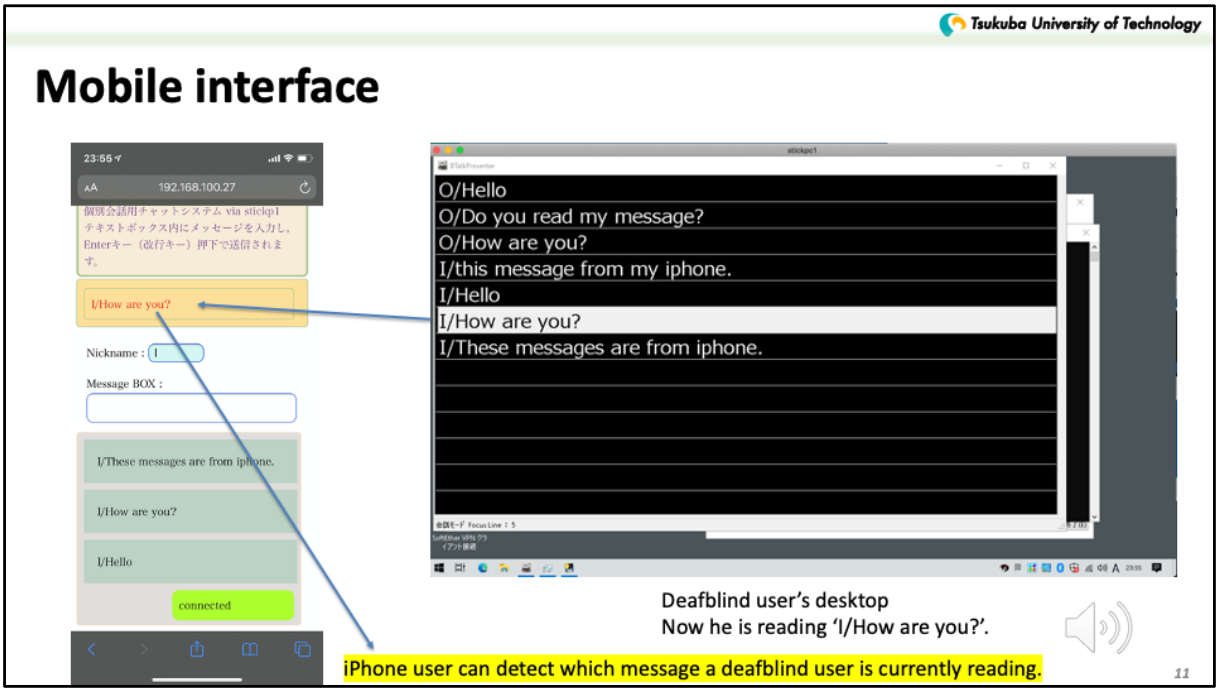
This slide shows outline of our developed system
Our developed system consists of three components: a Web-based chat support application that supports conversation input, a system that outputs conversation information to the deafblind user in Braille, and a server system that relays all these important information.
The base hardware is implemented by one ultra-small stick PC, and communication is achieved by a star-type network based on this PC.
Each client was connected to the same network segment as the stick-type PC via VPN, and the address used for communication was the local link address.



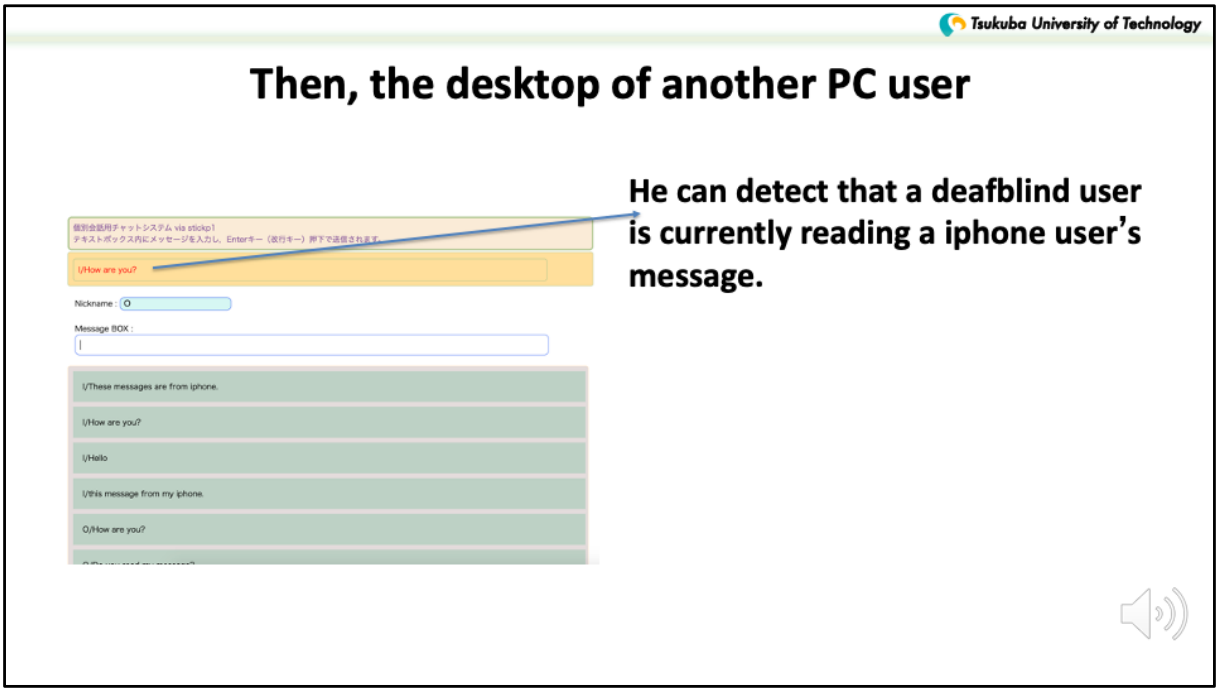

The Development environment shows in this slide.
Development tool is Visual Studio 2019 C# for developing braille display controller which a deafblind student uses.
And,
Other communication servers for transmitting summary text or chat are developed by Python 3.8.
These severs work on the Linux operating system.
As for the client for deafblind persons,
The hardware which makes up our system consists of a standard PC which runs on the Windows 10 operating system, including an installed copy of the Non-Visual Desktop Access screen reader, otherwise known as NVDA. NVDA supports many Braille displays, including the Braille Memo that is produced in Japan, thus allowing for Braille output to be provided once a Braille Memo or Braille display is hooked up to the Windows 10 pc.



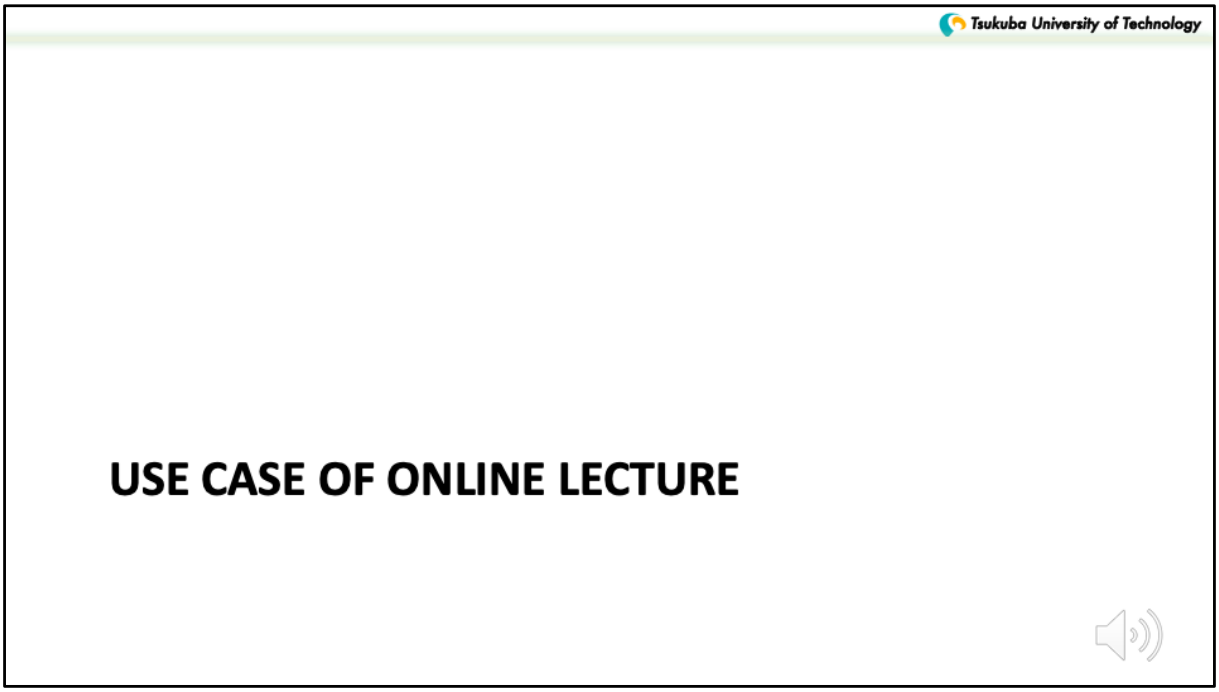

This system consists of extra hardware components such as Braille sense U2 and Intel's Compute Stick.
NVDA was used to generate the data displayed on the braille display.
The developed control software has a function to display Braille when the deafblind person needs it and a function to transmit the displayed Braille information to the relay server.
The relay server communicates between the web chat and the Braille control client software and relays from the Braille control client to the chat client software by using WebSocket protocol.



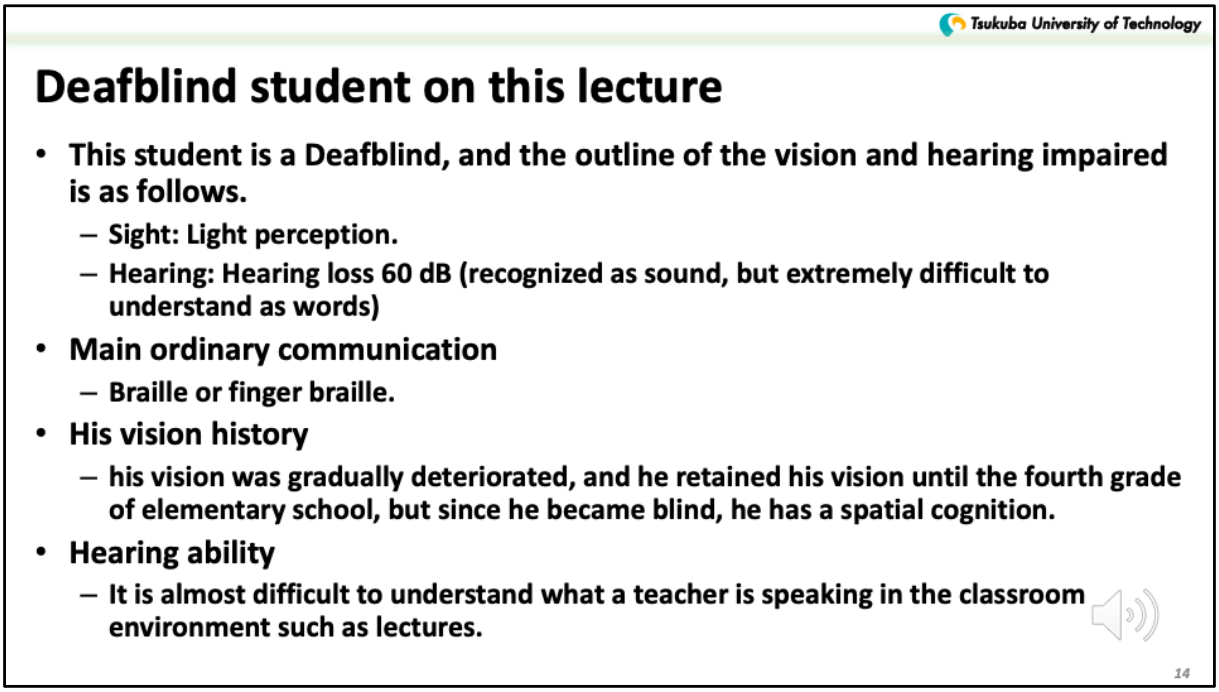

This slide shows mobile interface and then deafblind user's client desktop.
In the proposed system, based on the communication environment by Web socket, the conversation is established by utilizing the mechanism of conversation transmission by the character information with many people.
On the Web interface, conversation input corresponds to voice input, and conversation output can be read out by voice as well as confirmation on the screen.
This component is used by the hearing-impaired and the deafblind user can utilize the functional part that speaks.
You can check what you say on the connected braille display.




This slide shows the desktop of another PC user.
This user can also detect which message a deafblind user currently reading.
It means he can know when he can talk to him.
What is the most important to speak deafblind person.
It is to make sequential message streaming.
So we can know the best timing when we should send our messages.
The most important thing is that a deafblind user's accessing form is a sequence form.



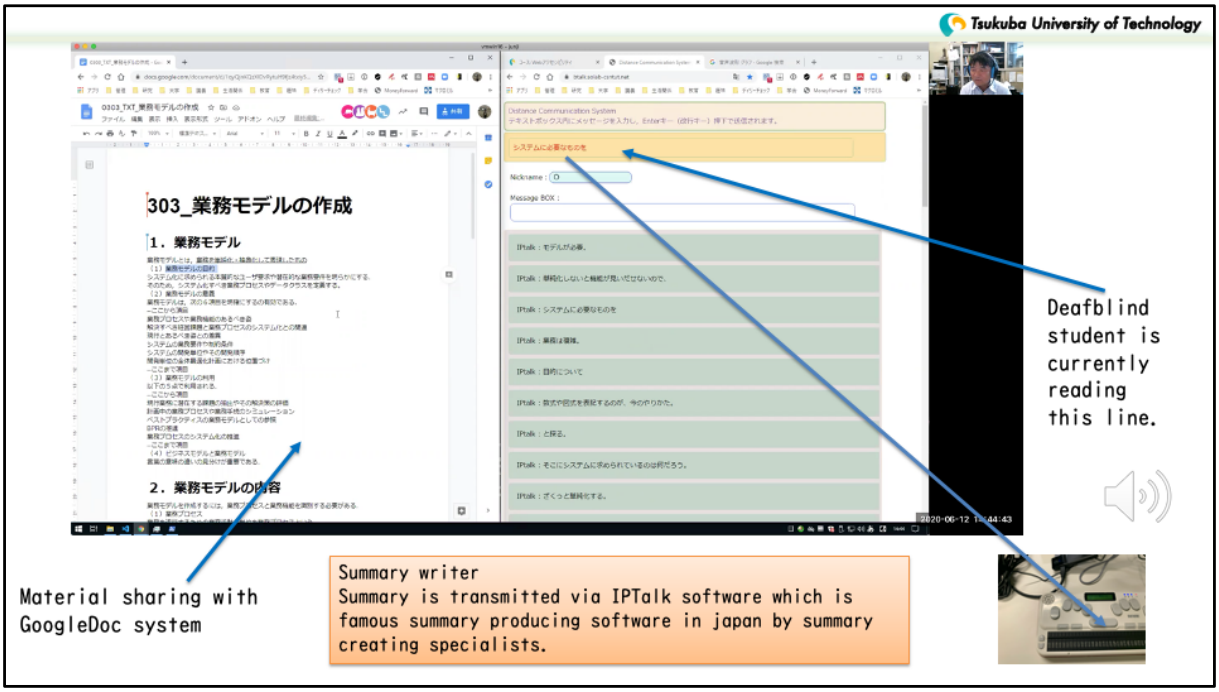

Let me show a use case of our system for online lecture.
Our developed system in this case is a little different from the system described in our paper.
What is main different point is Feedback response function works on WebSocket communication only.
Also we used the specialists to input summary text  of teacher's talking for a deafblind student.




This slide shows about a deafblind student.

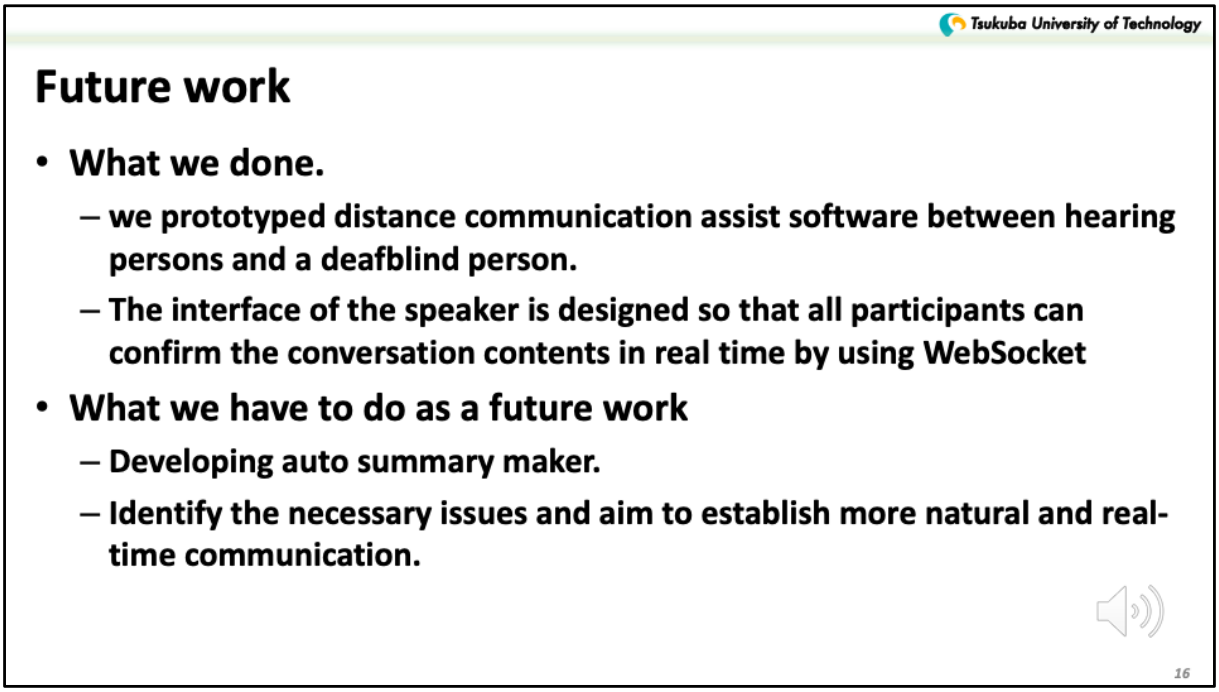
This student is a Deafblind, and the outline of the vision and hearing impaired is shown in this slide.

Since this student is a Deafblind, uses Braille or finger Braille is the main ordinary communication.
In addition, his vision was gradually deteriorated, and he retained his vision until the fourth grade of elementary school, but since he became blind, he has a spatial cognition.
Hearing ability became more difficult from the first grade of junior high school, and now is recognized as severe hearing loss, also almost difficult to hear in the classroom environment such as lectures.
Therefore, unable to hear screen reader in the class etc.
So, the way of communicating this student is use braille or finger braille.




This is an example of online lecture which includes deafblind students participate.

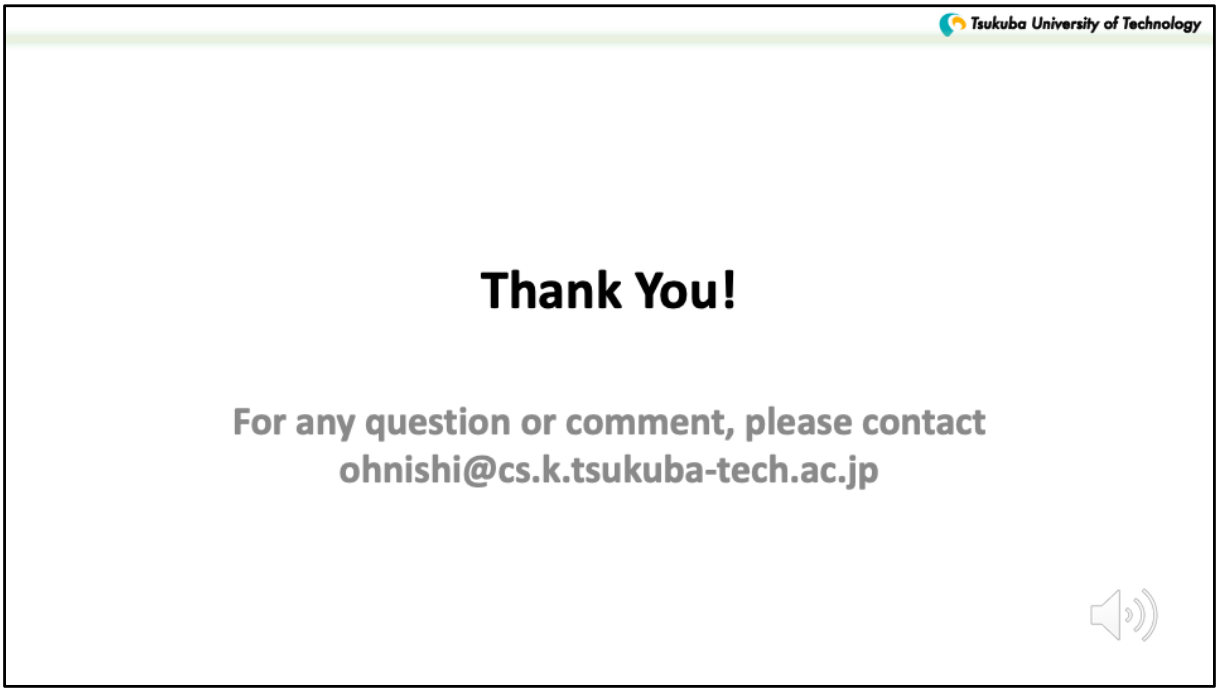
A teacher uses googledoc application to share lecture materials with students.
Then he can detect which part students are currently accessing on this document.
Also, students can leave their comments on this document.
So, a teacher can answer against student's needs anytime.
On the other hands, a teacher can mind status of summary interpreter situations which summary creating specialist is transmitting through the network.
And a teacher can detect which line a deafblind student is reading by braille display on this web chat interface.
It means he controls the speaking speed according to the listener.
So our system can help for a teacher to know each student's conditions and their needs.




In this study, we prototyped distance communication assist software between hearing persons and a deafblind person.
The interface of the speaker is designed so that all participants can confirm the conversation contents in real time by using WebSocket communication so that information can be shared without barriers even if the hearing participants are not familiar with tactile Sign Language and other specific skills used by deafblind people.
By using this system, it is not necessary to have a dedicated person who is in charge of conveying the different messages to the Deafblind participants.

However, transcribing every word into text is time consuming and inefficient, taking into consideration the situation of the student who is Deafblind.
We use a lot of unnecessary words while speaking such as um, err, etc., which creates difficulties for the student when reading the information in Braille.
Currently, the situation is that 1 or more students usually type out what the teacher is saying in real time in order to assist the Deafblind student.

It is possible to pick out only the necessary parts of what the Japanese teacher is saying.
Therefore, we would like to use AI technology to improve this process in order to assist the Deafblind student to access information more efficiently and effectively.
In the future, we will evaluate the prototype system using remote communication, identify the necessary issues, and aim to establish more natural and real-time communication.




That is all what I would like to say.
For any question or comment, please contact my e-mail address shown in this slide.
Thank you for your watching.