Virtual Go to School (VG2S) : University Support Course System with Physical Time and Space Restrictions in a Distance Learning Environment

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Summary
Distance learning universities provide online course content. The main methods of providing class contents are on-demand and live-streaming. This means that students are not restricted by time or space. The advantage is that students can take the course anytime and anywhere. Therefore, unlike commuting students, there is no commuting time to the campus, and there is no natural process required to take classes. However, despite this convenient situation, the attendance rate and graduation rate of distance learning universities tend to be lower than that of commuting universities. Although the course environment is not the only factor, students cannot obtain a bachelor's degree unless they fulfill the graduation requirements. In both commuter and distance learning universities, taking classes is an important factor in earning credits. There are fewer time and space constraints for distance learning students than for commuting students. It is also easy for distance learning students to take classes at their own timing. There should be more ease of learning than for students who commute to school with restrictions. However, it is easier to take a course at a commuter university that conducts face-to-face classes. I thought that the reason for this was that commuting to school was a part of the process of taking classes for commuting students. Commuting to school was thought to increase the willingness and motivation to take classes. Therefore, I thought that the inconvenient constraints might encourage students to take the course. In this research, I focused on the act of commuting to school by students. These situations are also applied to the distance learning environment. The students have physical time constraints. To achieve this goal, I will implement a course restriction method that aims to promote the willingness and attitude of students. Therefore, in this paper, I have implemented a virtual school system called "virtual go to school (VG2S)" that reflects the actual route to school.

Key words:
Distance learning, e-learning, Educational Engineering, User Experience, Interface Design

1. Distance Learning Environment

1.1 Current Situation of Distance Learning

In this chapter, I describe the current situation of distance learning. Distance learning is mainly divided into live streaming type and on-demand type class contents. A live-streamed class has the same time constraints as a commuter school. On the other hand, the course can be taken from anywhere with an Internet connection. In the case of on-demand class contents, the school records and distributes the contents to the students in advance. Students can take the course at any time and any place with internet access. In recent years, the global spread of COVID-19 has made face-to-face teaching difficult in many schools. For this reason, many school have provided the class contents by distance learning [1]. Many universities provided live-streamed classes by using video calling applications such as YouTube and Zoom. In the on-demand format, some classes were recorded in advance and uploaded to the class support system for students to take. Each university provided distance learning in various ways. Against this background, distance learning will be necessary in the future in the field of education. On the other hand, distance learning schools originally offer online classes. Depending on the method of providing class contents, it is more convenient than commuter schools. However, it is difficult for distance learning students to continue their studies, even though they can take classes more flexibly than normal university's students [2]. There are various reasons for this, but I thought that one of them was the fact that students could take the course anytime and anywhere. The author thought that this freedom of access might f normal university decrease the motivation of the students. I take as an example a study of attendance at a distance learning university [3]. Anma's research analyzed the pace of taking first-year required courses at a cyber university. The pace of the course is divided into several categories. In the first pattern, there are students who take the course ahead of time. In the second pattern, there are students who complete the course before the attendance period. The third is for students who complete the course after the due date. The fourth category was students who were unable to complete the course by the due date and eventually dropped out of the course. About 35% of the students completed the course before the due date. In addition, 14% of the students withdrew from the

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course without obtaining credits. About half of the students do not take the course until the very last minute, or they end up not being able to acquire the credits. This result suggests that half of the students in the distance learning universities may not be able to take the courses correctly in the allotted period. One of the possible reasons for this is that distance learning students have to take courses online on their own initiative. Therefore, it is necessary to have a strong motivation to attend and study. Therefore, it is more difficult for students to continue their studies than for commuting students. On the other hand, students have to physically move from home to school. Many students take into consideration the time it will take to get to the university by public transportation. There is a big difference from distance learning university students in this point. If student don't have the motivation and attitude to take a class at the university when student leave home, student will not be ready to go out. Therefore, the student is motivated to take the class at that time. In the case of distance learning universities, students can take classes whenever and wherever they want. Then, take the course online. First, the first step is to be prepared to take the course. Next, open the laptop, access the Learning Management System (LMS), and take the course. In this process, students take courses without switching from their personal life to the course. However, since commuting university students change their minds and attend university classes, I thought that the commuting time might be an important time for them to attend classes. Therefore, I thought that the strong motivation of the student is important for the class style of the distance learning university, which seems to be highly convenient at first glance. In addition, the author thought that it may be more difficult for students to continue their studies than for normal university's students. Therefore, in this research, I focused on commuting to school, which is necessary as a physical process to take classes at a commuter student university. Therefore, the same restrictions as for commuting should be applied to distance learning universities. In addition, I think that it can promote students' motivation and attitude to take the course, and I construct the system for this purpose.

1.2 A Comparison of Video Calling Applications Used in Distance Learning

Several video calling applications are used in the current distance learning environment. Typical examples include Class for Zoom, Microsoft Teams for Education, and Cisco Webex Meetings. These have advantages and disadvantages depending on the situation in which the application is used. These are summarized in Table 1. First, I will explain Class for Zoom as an existing video calling application that is very effective as a communication tool for remote classes, providing a sense of realism and convenience. Class for Zoom adds an educational element to Zoom's functionality. This application is more similar to in-person classes for teachers and students than a conventional video calling application. In addition, there are functions such as being able to take a class in a virtual classroom by sitting in any seat. There are also functions that allow students to experience the realism of in-person class. However, distance learning classes, students can write assignments and reports, and share files of course materials used in class. These can be created remotely by multiple people. Both Class for Zoom and Microsoft Teams for Education are ordinary video calling applications that are specialized for distance education environments. On the other hand, CiscoWebex Meetting has the same functions as Zoom and Microsoft Teams. It can be used comfortably as a video calling application, but it is not specialized for remote class environment. Based on these points, I compared our proposed system with other video calling applications. This system is designed for on-demand remote learning, not for remote learning by live streaming. Because of this, it does not provide the same sense of realism as the video conferencing applications that are being compared. However, it is very convenient for students because they can take the class at the place and space of their own choice. In addition, existing video calling applications are not equipped with a system to restrict access. The concept of commuting, which is a natural process in commuter universities, has been incorporated into the online class environment. This point is very different from other video calling applications used in distance learning.

2. The difference between normal universities and distance learning universities

In this chapter, the differences between normal universities and distance learning universities are presented, and the advantages and problems of both are mentioned.

2.1 Commuting time to school

Normal students are required to commute to the university by themselves before attending classes. Normal university students do not have immediate access to classes when they want to take classes. By commuting to the university, students can decide their intention to attend classes and then take action and go to the university. Therefore, normal university students cannot take classes anytime, anywhere, and immediately like students at distance learning universities. However, they are acting with a clear purpose and intention to take classes at the university. On average, college students spend 30 to 60 minutes commuting to school [4]. While commuting to school, students can prepare the intention to take classes by themselves. Also, since Student are out of the house, they have to take classes. It can be said that they are creating this situation themselves.

In other words, students are using their commuting time to prepare for their classes at the university. However, distance learning students have to take the course without being prepared for it. In addition, student can take the course in the room where they usually live. That is why it is easy for them to act outside of class because there is no monitoring from anyone. The lack of commuting makes it difficult for students to keep up with their studies if they do not keep their own rational mind. I thought that the physical movement of commuting and the physical space of the classroom were important for students to take courses. Therefore, in this research, I utilize the act of commuting to school by university students. The final goal is to make it possible for students to commute to school in a virtual space, just like normal university students. In addition, a course restriction system will be established to promote motivation and preparation for the course.

Tool Name	Class for Zoom	Microsoft Teams for Education	Cisco Webex Meetings	Virtual Go to School (VG2S)
sense of reality	○	○	△	○
convenience	○	○	△	△
Communication	○	○	○	△
Course Restrictions	×	×	×	◎
Go to School	×	×	×	◎

Table 1: Comparison between existing video calling applications and VG2S.

2.2 The University as a Place of Community

Students of normal universities commute to the university to attend classes. Then, students communicate with each other in the physical space of the university. For example, students take classes next to each other in university classes and communicate with each other through club activities after classes. The original purpose of the course is to obtain credits and graduate. However, communication with other students can be one of the purposes for commuting to school. Under these situations, students do not attend university simply to take classes. The communication among the students is an extension of the course, and it is thought to connect to the attendance of the class. On the other hand, students of distance learning universities basically do not need to commute to school, unlike normal university students. Some distance learning universities in Japan require schooling several times a year. There are some universities that allow students to earn a bachelor's degree through full online courses that do not require a full commute. Therefore, unlike normal university students, there is almost no opportunity for students to communicate with each other. For normal university students, the campus is a place where they can communicate with their friends and get a chance to take classes. However, the campus is not the time and space for distance learning students to interact with other normal university students. Therefore, students of the distance learning university basically access the learning management system for the sole purpose of taking courses. Thus, there is little possibility of communication outside of the course. These differences may be one of the factors that encourage students to commute to school.

2.3 Graduation Rates of Distance Learning Universities

According to the results of the Basic School Survey published by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2018, the percentage of students who graduated from a four-year university in Japan within four years of enrollment was around 80% [5]. On the other hand, I compare the graduation rate of distance learning colleges. According to the results of the accreditation conducted by the Open University of Japan in 2017, from 2014 to 2016, the percentage of students who graduated within four years of the standard completion period ranged from 24.6% to 27.0% in the College of Liberal Arts [6]. Although I have picked up only one distance learning university, I can see that the graduation rate is quite different from the average graduation rate of normal universities. Normal university are more difficult and inconvenient to attend, but have a higher graduation rate within the standard course of study. This may be due to spatial limitations in the classrooms where they commute to school and take classes. This means that the students are taking classes and getting credits steadily. Therefore, it is no exaggeration to say that these results appear. However, many things have been made more convenient by the

modern society using IT. A distance-learning university would be a better choice for students who are not restricted by time and space. The graduation rate of normal university is much higher than that of distance learning university, even though the distance learning university can be taken anytime and anywhere. From this point of view, it is thought that the ease of taking courses for distance learning students may be a factor that prevents them from taking courses. Therefore, in this research, certain restrictions and limitations are imposed on the learning management system used by students of distance learning universities. This constraint allows time for students to prepare themselves for the course. In this research, I will develop a method to limit the attendance of students in a distance learning environment with physical time and space constraints.

3. Related Research

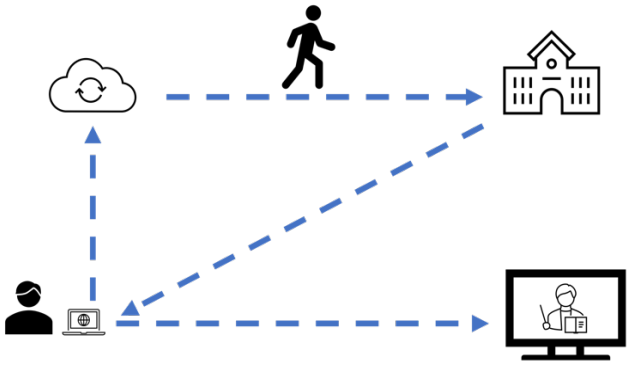
In this chapter, I explain related studies. In this chapter, I show the researches which aim to promote the students' attendance in the distance learning environment. First, I mention the research conducted by Li et al [7]. Lee et al. focus on the lack of student comments in distance classes. In order to improve these problems, they developed a system that covers a part of the slides used in the class. If the students did not speak a certain number of times, a part of the covered slide would not be displayed. In a class for normal university students, the teacher and students are in the same space. Thus, the teacher can see how the students are doing. Teacher can be asked to respond immediately to simple questions or answers that are relevant to the class. This will encourage students to speak up and raise their awareness of the course. However, in the case of distance learning classes, the teacher can only see the students on a flat screen. In addition, it is difficult to observe each student in detail in the class due to the limitation of the system. Such factors may make it difficult for students to speak up, and as a result, their motivation to participate in the class may decrease. Lee et al.'s system requires students to participate in the class by speaking in order to display some of the covered slides. If you do not actively participate, students will not be able to grasp the whole picture of the slides. Thus, students need to be proactive in making comments. This system also promotes active participation in distance classes. The similarity with this system is that it reverses the original convenience of distance classes and imposes certain restrictions on the students. However, this system is not designed to encourage students to take classes after they have started, but to restrict the process of accessing the system and starting classes. Hence, the system is designed to motivate and encourage students during the course. For this reason, it differs from our research. The next research is conducted by Ibaraki et al [8]. Ibaraki et al. have developed a video conferencing system for distance classes. The seats in the classroom are displayed on the system screen, and the user can freely sit on the seat. By selecting a seat, users can express their current emotions through icons. It also has a chat function and a group chat function. They propose a system interface that gives students the feeling of sitting next to a friend in a class at the normal university. This research is different from conventional video communication systems in that it allows students to communicate with each other. It reproduces the communication situation of a normal university's student in a real class. Based on the above, a system to encourage students to take distance classes has been proposed. This system is an interface system that reproduces the realism of face-to-face interaction during the course. In addition, the system proposed in this study focuses on commuting to school. The process of taking the course will be reproduced as if it was a commuter university. Therefore, this system has the same direction of realization, but the contents of the system are different.

4. System Overview

In this chapter, I describe the outline of the system that I construct in this research. In our system, the location information of the student is obtained when the student logs in to the system. Students will not be able to start the course until the commuting time for the distance to the university has elapsed. By limiting the number of classes, the students are restricted to the same amount of physical time as commuting students. The system is constructed with the aim of promoting attitudes and motivation toward the course. I have implemented a virtual school system called "virtual go to school (VG2S)" that reflects the actual route to school.

4.1 Course Restriction Method

This system obtains the location information of the student who logged in to the system. The next step is to control the travel time to the location where the school is located so that it is not possible to take the course. The case where the author belongs to Cyber University, Fukuoka Campus, is set as the destination is given as an example. When a student logs in to the learning management system to take a class, location information is obtained. If your login location is Hakata Station in Fukuoka Prefecture in Japan, it will take about 30 minutes to get there by bus. In that case, student will not be able to view the class contents for 30 minutes after you log in to the system. In addition, the avatar is displayed on the map in virtual reality for the time until the course is unlocked. The student can see how they are moving in virtual reality. During this time, students will review the previous lecture and prepare for the next lecture. This will prevent you from taking courses at any time. This limitation can promote the willingness to take the course. Figure 1 shows a possible flow of the course.



4.2 Commuting to school in a virtual space

I mainly use Google Maps for commuting in the virtual space of our system. Acquire the location information of the student at the time of system login and start the movement. The time required for travel is based on the time required to use public transportation. In addition, if a student physically visits the campus without using an avatar, student can start the course immediately because the location where student logs in to the system coincides with the destination. In addition, at a distance learning university, students basically have to take courses alone, and it is very difficult to interact with other students who attend the same university compared to commuting students. Since the students commute to school in a virtual space using Google Maps, if there are other students commuting to the destination campus at the same time, they can see the other students commuting on the screen. In this way, I thought it would be possible to reproduce online the incidental encounters of commuting students with their friends and classmates who attend the same school at university. An image of the envisioned system is shown in Figure 2.

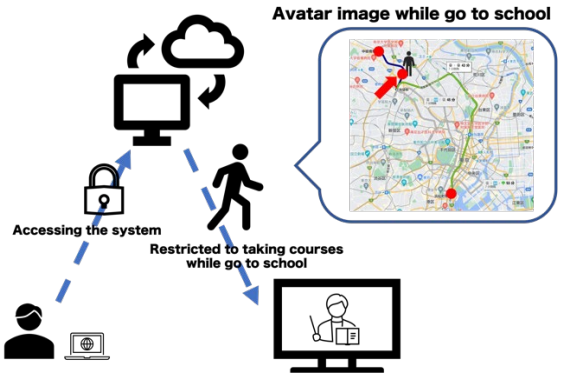


Figure 2: Commuting start and system limitations

4.3 Access points in the virtual space

In this system, students need a target point of the campus to be their destination when they take a course. In a normal university, there may be several campuses for each department of the university. However, in the case of distance learning, students basically do not commute to school, except in cases where screening is necessary. In this system, a campus is required as a destination because students are required to commute to school in a virtual space. However, one of the advantages of distance learning is that there are no restrictions on where one lives. Therefore, even if the campus is located in Tokyo, students who live in faraway place or overseas have to spend much time commuting to the campus to use this system. Therefore, it is necessary to have an access point, which is a virtual campus, at a distance where students who use the system can commute to school on average. In this system, the administrator can set up access points at necessary locations. Hence, there are several access points in large cities where students are concentrated. As a result, the commuting time can be mitigated to some extent in the virtual space. In addition, distance learning schools basically do not require commuting to school. No advantage was found by place of residence. In our system, the advantage is based on the place of residence. This situation is similar to that of commuter students and can be realized in distance learning schools.

4.4 Course Restriction System

Our system utilizes the user's location information when logging in to restrict access to the course. The travel time to the access point specified by the administrator in the virtual space is the "commuting time" of the user. As shown in Figure 3, the starting point of the user's login is shown as a house icon point, and the destination campus is shown as a school icon. The travel time on the way is the time taken by public transportation. In addition, the original universities were established in fixed campuses. Normal university's students have to spend time commuting from their own residence to the campus. On the other hand, in our system, the administrator can set up an access point in the virtual space at any location. The system is able to maintain some equality in commuting time for distance learning students who live in diverse environments. After logging in to the system, students cannot take courses, but they can see the current status of their commuting as shown in Figure 3. The Fig. 3 is commuting to school, but when the travel time to the destination has been exhausted on the map in the virtual space, the display changes to "going to school". When the status changes to "going to school", users can take the class they want for the first time. In this way, in a distance learning environment, it is possible to set certain restrictions on the environment that allows students to take classes

anytime and anywhere, and to increase students' interest and motivation before they start taking classes.

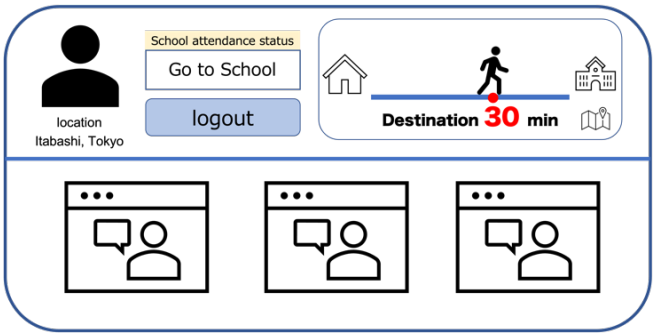


Figure 3: Screenshot of Virtual Go to School (VG2S)

5. Conclusion

In this research, I have developed a system to limit the number of students in a distance learning environment with physical time and space constraints. In addition, in this paper, I developed a virtual school system called "virtual go to school (VG2S)" that reflects the actual route to school. I have developed a novel system to encourage students to take classes in a distance learning environment in the future. In the case of normal universities and distance learning universities, the process of taking courses is clearer and easier in the case of normal universities. This is a good environment for students to learn. It is important for distance learning universities to establish an environment similar to that of normal universities one by one. As a result of the recent COVID-19 outbreak, educational institutions around the world have been forced to establish distance learning environments that are comparable to in-person classes, albeit temporarily. Even if such a situation occurs, the use of this system is expected to promote attendance in remote classes. As a future development of the research, it is necessary to investigate to what extent the course restriction method of this system affects the attendance rate in a remote class environment. For this purpose, I will conduct experiments on subjects after the implementation of the system and analyze and improve the system in the future. In this research, I tried to improve one of the distance learning environments by focusing on the commuting point. In the future, I will conduct research on the distance learning environment, focusing on the behavior of students after they start or finish the course. In addition, I will implement a system for a distance learning environment, emphasizing the importance of developing a learning environment equivalent to a face-to-face class. I will eventually integrate these functions and develop and operate a large-scale learning management system.

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