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# Research on Improving the Decision-Making Environment in Architectural Projects Through the Use of General Digital Technology

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**Abstract:** How information is communicated and stored is an important factor in the decision-making process for architectural projects. With the recent spread of smartphones among all generations and the rapid expansion of various digital services, an environment has been created in which anyone can easily use digital services. In Japan, there are a variety of Social Media platforms, of which LINE is the most popular among people of all ages as a means of communication. In the business world, chat tools have emerged as convenient tools, and teams are increasingly using chat to exchange information on a day-to-day basis.
In this study, the author will examine how information communication, storage, and decision-making, which have been carried out by conventional means, can be streamlined through the use of a combination of highly versatile Social Media services and 3D digital technology, which has become easier to introduce even in small companies over the last few years. The project will examine how information communication, storage, and decision-making can be streamlined through the use of 3D digital technologies, which have been introduced in the past.

**Key words:** information communication, information storage, Social Media services, 3D digital technology

## 1. INTRODUCTION

Architectural projects continuously generate the greatest amount of information that is most critical to building-related decision making during the period between the building's completion and the next major renewal timing, after decades of ownership. Streamlining the communication and storage of information during this period will have a significant impact on decision making throughout the building's life cycle. By combining 3D digital technology, which has greatly reduced the hurdles to implementation over the past few years and is now easier for even small firms to adopt, with several highly versatile communication platforms, it is possible to streamline the communication of information and decision-making that has been done by telephone, e-mail, fax, on-site meetings, face-to-face meetings, etc. The author will verify through actual architectural projects how information transfer and

decision making, etc., which have been conducted by telephone, e-mail, fax, on-site meetings, face-to-face meetings, etc., can be streamlined.

## 2.Past Studies

Above mentioned issues can be found in several past papers. In information communication in building projects, there are cases where only drawing information is available, which is difficult to decipher for those without specialized knowledge, and information is not adequately communicated.

Even if a 3D model is used to share visual information beyond the drawings, there are limited means to immediately communicate information from the model. In Study 2013, Nakama et al. developed a system that facilitates information communication by combining 3D models with chat tools and other functions.

In Study 2021 by Shinomiya et al., the characteristics of users' and clients' design thinking were clarified by reproducing a VR space of the design object and then conducting a dialogue while manipulating it so that people without expertise can share visual information in a realistic manner. Furthermore, we analyzed the dialogue process between multiple entities using the VR space and the design space, and clarified that a space with design information embedded as a VR space in front of them enables them to examine the object from multiple perspectives. In addition, by adding a function to edit the object in real time, we showed the specifics of the "thinking while creating" process.

In recent years, social media services have become popular among people of all ages, and everyone is using some kind of service. In addition, services such as 3D scanning services that can compose live-action-based VR spaces with relatively simple photography have become available at low cost. If all parties involved in a construction project can use a general-purpose system rather than a dedicated system to communicate information on a construction project, the problems of information communication that have existed up to now will be largely resolved. To the best of the author's knowledge, there are no papers that have reviewed these studies using them on an actual project on a trial basis.

## 3.Research Methodology

In the actual architectural project, the author will conduct an experiment in which chat tools and 3D digital technology will be used to replace paper drawings, e-mail, and face-to-face meetings as much as possible to facilitate the project. The verification experiment will be conducted using social media services and 3D digital technology, which are highly versatile, widespread, and have low hurdles to introduction, instead of using dedicated construction management services. The results of this experiment will be verified. The services used in this study will be referred to as "general digital technology.

In architectural projects, a great deal of information is newly created, transmitted, stored, destroyed, and sometimes lost. This section discusses the methods and formats of information stored as a result of actively utilizing the above tools, as well as the routes to accessing the information.

LINE, the most popular chat tool in Japan, and Slack, a highly popular business chat tool, were used to communicate information. In addition, Matterport, a highly versatile 3D digital technology, was used.

Basically, existing communication methods such as telephone, e-mail, paper drawings, and faxes were used as necessary. In addition, the autor will actively use new communication methods that can be substituted for existing ones. The number of visits to the construction site by the parties involved was also reduced as much as possible.

The three main communication channels were the client, the designer, and the contractor, with the designer and contractor and the client using LINE as the main means of communication. The designers

and contractors used both Slack and LINE, while the site supervisors and designers, and the professional contractors used LINE as their main means of communication. This was set up in consideration of the age range of the parties involved and the hurdles to introducing the system.

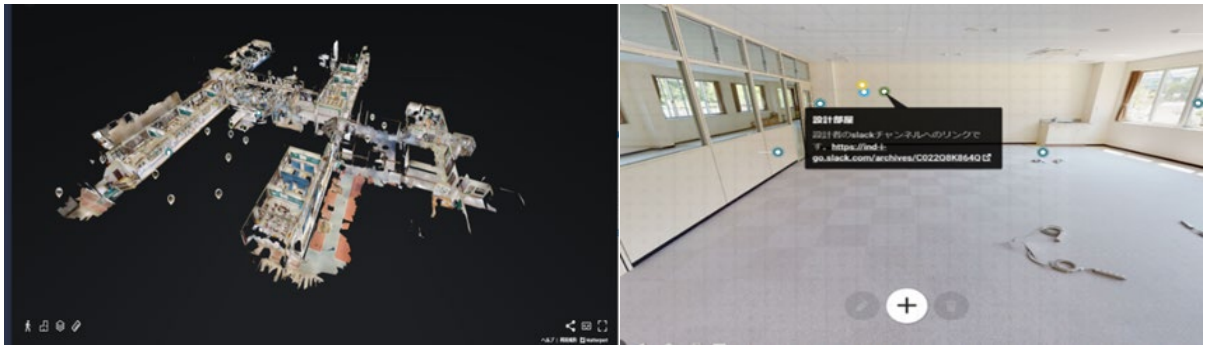

fig.1 Matterport Interface

**Table 1.** Project Outline

| No. | Names | Type | Implementation period | Scale |
|---|---|---|---|---|
| 1 | School M | Interior of teacher's room | June.2022－ Augst.2022 | 210㎡ |
| 2 | House K | Renovation of the house | April.2023－ July.2023 | 173㎡ |

## 4.Results

In the course of project No.1, interior construction work at a high school, Slack, a chat tool, was introduced as part of the communication with the school's staff.

The content of the interview with the client was entered on the designer's side and utilized in the renovation design study while confirming details by viewing the VR space. Information obtained during the study, items to be considered, and team communication during the study were stored in Slack.

The contents of the exchange included class placement studies prepared by the client, detailed site photographs, proposal drawings, minutes and process chart files, and proposal data.

The presence of the 3D digital space reduced the amount of site photography required and reduced the need to visit the site again.

The simple conversation-like exchange that occurred, which was not possible with e-mail, made it possible to communicate in a short span of time.

The amount of conversation and communication between the client and designer increased dramatically with the introduction of this system, and "consultations" during the mid-stage of the study process increased.

Fig. 2 shows an example of a conversation on the chat between a school representative and a designer. After the designer sent the 3D modeling image he had created in advance to the school representative via chat, he received a comment with a question in response. The designer asked if there was a need for a partition between desks in the staff room. The response from the designer prompted the person in charge to check internally with the board chair and principal with the answer. This led to a decision on the design. This is one of the cases where the decision-making process was completed using only a chat tool.


Fig. 2 Slack communication between the school and the designer

This approach was introduced about one year after the project was launched. Until then, discussions were held only once a month at regular meetings. During that time, the only communication with the person in charge was by e-mail and telephone regarding meeting appointments and matters to be communicated, and there was little exchange of information regarding the content between meetings.

And in the limited meeting time, points that could not be fully discussed were often left undiscussed. Since the project members were teachers, they were often late or left in the middle of the meeting due to classes they were in charge of, and there were many restrictions on the time and timing of face-to-face meetings and convocation.

Within two days of introducing the chat tool, small "questions," "consultations," and "communications" began to be shared. Although this kind of communication is not impossible with e-mail, the ease of use of the chat tool and the high tempo of communication made it possible, However, the fact that the communication is easy to use and fast-paced, like a chat tool, is what has stimulated the communication.

The ability to conduct such small exchanges in a fast-paced manner is expected to enable the design side to proceed with the design process without rework.

Next, the paper report on a case in which a private home was renovated.

Fig. 3 shows an example of a designer confirming the design details with the client using a chat tool. 2 3D models were created and the images were sent to the client. The color of the tiles was determined through this exchange. The final confirmation of the flooring material decision was also made via the chat tool.

There was a case in which the client went to the site alone to confirm and make decisions.

This is an example of the interaction between the client and the designer in a situation where the client was on site and the designer was not. On this day, the designer had other business and could not go to the site, so a face-to-face meeting could not be set up. In advance, the designer sent information to the client via a chat tool, as shown in Fig.4, including items to be decided and information to be confirmed at the site. The client sent questions and confirmations to the designer while checking his/her smartphone at the site.

The contents of the chat included a request to determine the colors and specifications of the curtains, roll screens, and entrance gate, as well as other items to be checked at the site on the day of the work, including precautions for entering the construction site. The client checked the samples of curtains and roll screens that had been prepared in advance at the site, and the colors of the curtains and roll screens were decided during this exchange.

In addition, a question from the client was sent to the designer on the same day by the Internet line contractor, asking where the TV distributors were located, and the question was answered in real time by the designer, who was not present at the site, eliminating any questions from the client.


Fig. 3 Designer sends design proposal to client and decision


Fig.4 Communication with the designer when only the ordering party visited the site to check

Chat tools and the 3D digital technology Matterport were also actively used to communicate information within the team of designers, contractors, and designers, as well as between designers and specialty contractors, and between prime contractors and specialty contractors. Fig.5 shows an example of communication between the designer's representative and the design manager on site and in the office. Here, the designer and the design manager confirm detailed information about the scope of construction, which would be difficult to do over the phone, as well as visual information about the status of the structure at the site. Fig. 6 shows an example of confirmation by capturing a live-action VR space of the

construction site using Matterport and writing confirmation items on the screen. The person in charge of design at the office captured the screen at an angle of his/her choice, used the image writing function of a tablet or smartphone, and sent it to the person in charge of design at the site via a chat tool.

Fig.5 Communication that is difficult to convey by phone. Photographs were taken on site, and confirmation details were sent on the spot via a chat tool.


fig.6 Designer sends confirmation to the site

## 5.Discussion

The following are the advantages of using a general-purpose digital tool, based on the verification conducted this time.

1.The number of visits to the job site by the designer has been significantly reduced.

2.The number of face-to-face meetings has been reduced, which in turn has reduced the time required for meetings and travel to the job site, thereby streamlining the work process.

3.There are many exchanges that would have taken only a few minutes if they had been conducted via chat. This has prevented mistakes due to lack of confirmation, and has partially accelerated the finalization of design information, thereby preventing delays in the process.

4.The ability to communicate information without having to go to the site has increased the frequency of information transfer, facilitated smooth information transfer, and improved the accuracy of confirming design and construction information.

5.The ability to communicate information without having to go to the job site has increased the frequency of information transmission, facilitated smooth information transmission, and improved the accuracy of confirming design and construction information.

6.The latest information, such as process charts and detailed drawings, can be checked here, making it easy for anyone to access.

Next, the issues can be summarized as follows.

1.The number of visits to the site was reduced, resulting in less direct communication, which in turn led to, or almost led to, other mistakes.

2.The number of visits to the site was reduced, which led to less direct communication, which in turn led to or almost led to other mistakes.

3.The increase in the number of communications through chats caused some messages to be missed.

4.The people concerned did not enter the 3D digital space as often as the person who introduced the system thought they would.

5.Because of grouping within the chat, some messages were not shared with some members.

6.Managers forgot to update information such as process charts and detailed drawings, and received outdated information

As issues are addressed, it is expected that the use of general-purpose digital tools will further promote efficiency in the communication of information.

1.It is necessary to promote familiarity with digital tools among those involved through continuous use. When people accustomed to traditional methods use new methods, mistakes are likely to occur, especially in the early stages. Continuous use is expected to reduce mistakes and miscommunication.

2.Secondly, points where mistakes are likely to occur have also become apparent. One of them is that some members may lose track of the latest information due to information updates, and some members may miss a message.

3.It is necessary to brush up the method of grouping within chats and to carefully check who the sender wants to see the information. It would also be effective to set a rule that the person who confirms the information should take some kind of reaction to it. Since the more chat tools are used, the greater the volume of information, it is also possible to take these measures. These measures could be implemented on an ongoing basis to reduce the number of problems that are currently occurring.

4.In addition, there were cases where mistakes or misunderstandings occurred due to remote confirmation of information that should have been confirmed in person or onsite.

## 6.Conclusion

In this study, the author conducted an experimental effort to shorten the distance between architectural projects and the daily use of digital technology by actively using social media chat tools and 3D digital technology that are versatile and easy for anyone to install and start using immediately on their own smartphones and other devices. The result of this effort was the creation of a new project that would allow architectural projects to be conducted in a more conventional manner. As a result, the project progressed smoothly, with decision-making exchanges and confirmations taking place through short, easy, conversation-like exchanges that had not been seen in architectural projects using traditional methods. On the other hand, several problematic points were observed, such as the increased volume of information exchanged via chat tools, which induced mistakes. It is important to set strict rules among users and to understand the situations in which mistakes are likely to occur.

In addition, in the future, by thinking about interfaces, such as information transfer pathways, optimal tool use, optimal grouping, and transfer pathways between 3D digital tools and chat tools, the author believe he can create a more efficient and streamlined project progress environment by adding new tools to traditional methods in a natural way, while reducing user awareness and the burden of confirmation work. The author believe that he can create a more efficient and streamlined project progression environment. Efforts will also be needed to further deepen understanding of the various services and to increase the digital literacy of each of the entities involved. In addition, although not mentioned in this study, hurdles still exist at the point of implementation, such as security issues and difficulties in obtaining accounts for some companies. These issues also need to be considered.

## ACKNOWLEDGEMENTS

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