

# Chatting System for Mentally Ill NPU Patients

## Introduction to Engineering Design Final Report

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### Abstract

According to the special lecture by Dr. Nam Yun Yeong, during the IED class in Handong Global University, lots of problems are occurring in the NPU room with patients who are also suffering from mental illness. This project was done to find out some creative and reasonable way to solve the problems. Our team, Gold Bronze Stone, came up with some design alternatives for the problem and chatting system was chosen as the final design. This chatting system is used in the NPU and it allows patients who suffer from similar disease to have communication with themselves. Because most of the patients in NPU are aged, the system is built so that aged people can use it comfortably.

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## **Introduction**

### **Background Information**

On February 20, 2020, the first reported death due to COVID-19 in South Korea occurred in Daenam Hospital, a psychiatric hospital located in Cheongdo-gun. The outbreak of the epidemic in the hospital had a devastating impact, recording 103 cases of infection out of 103 inpatients. Most of the psychiatric hospitals that had been exposed to COVID-19 had similar problems, recording 6% of fatality, which is considered to be 1% in general.

The experts pointed out that there are various reasons that make psychiatric hospitals more vulnerable to infectious diseases than any other facilities, such as a system that encourages group life, and the condition of inpatients with weak immunity. Due to these reasons, the patients need NPUs more than anyone. However, there are no NPUs that are carefully designed for patients with mental weaknesses. These specific patients are more sensitive than ordinary people and are commonly exposed to the danger of experiencing the deterioration of mental state in a changed environment. As we carry out the project, we look over the existing NPU and examine the characteristics of the users, in order to revise the NPUs, especially for mentally-disordered people.

### **Problem Statement**

Most people in mental hospitals are familiar with communal life with psychological counseling which helps to relieve the depression of isolation. However, in NPU, this type of communal living is impossible, so patients who use NPU feel more isolated, which further worsen mental illness. According to the research, about three out of ten patients using NPU without having any mental disabilities, have complained of depression due to isolation. The medical team is also aware of this as a serious situation. In addition, since patients complain of depression due to isolation, medical teams are inevitable to deal with this, such as psychological counseling, which prevents them from fully focusing on treatment. Therefore, the problem we have observed is that mental deterioration caused by isolation is very common and dangerous. Therefore, our aim is to prevent patients using NPUs from worsening mental illness due to isolation, and to help the medical team focus more on treatment through the alternatives we derive.

## **Research**

### **Negative Pressure Unit**

Negative Pressure Unit (NPU) is a specially designed unit for preventing cross-contamination from room to room. With this specific purpose, the operation of the NPU requires intensive isolation in order to avoid contacts with infected patients and to keep a proper level of negative pressure.

According to the research, it has been shown that about three out of every ten patients who use NPU actually suffer from mental pain such as depression and anxiety disorder. Kang Ki-yoon, a member of the National

Assembly's Health and Welfare Committee, said that twenty-four (30%) out of eighty confirmed COVID-19 patients who were hospitalized at the National Medical Center's NPU were diagnosed with panic disorder, depression, and severe stress. According to the data submitted by the National Medical Center, they are patients with COVID-19 who are ordinary people who have not had mental illnesses. Sixteen out of eighty people (20 %) were found to have received anti-anxiety drugs and other medications after a psychiatric diagnosis. (Song, 2020) Even ordinary patients, without mental illness, suffer from worsening mental illness in the NPU. In this situation, the isolation of mentally ill people in NPU seems to require more consideration.

### **People with Mental Illnesses**

#### **Communal Life.**

In most cases, their residential environment is always exposed to contact with others. Institutions aim for communal living for therapeutic purposes. They are usually engaged in activities that involve having communication with each other, and group activities. However, this way of life is particularly vulnerable to infectious diseases and can never be conducted in privately isolated facilities such as NPU.

#### **Aged.**

According to statistics from the Ministry of Health and Welfare's Department of Disabled Policy, 62% of registered mentally disabled people in Seoul, 2019, were patients who are aged 50 or older. (Seoul Mental Health, 2019)

### **Reviewing Special Lecture**

The special lecture from Dr. Nam Yun Yeong has raised various suggestions regarding the use of NPU for mental patients. There are various problems, but we decided to focus on the mental pain of patients. We will list 3 main problems that Dr. Nam Yun Yeong taught in the lecture.

#### **The Fear for COVID-19.**

The fear of COVID-19 is one of the reasons that affect the mental status of the patients. The daily news of death of fellow patients from the media has led to a sharp increase in anxiety and stress. This increase in stress not only deteriorates mental illness but can also lead to various rejections.

#### **The Sense of Isolation Arising from Isolation.**

Isolation is an unfamiliar situation for those who have been in a group for a long time. The sudden forced isolation comes as a great stress for those who have been living a life of considerable dependence on others.

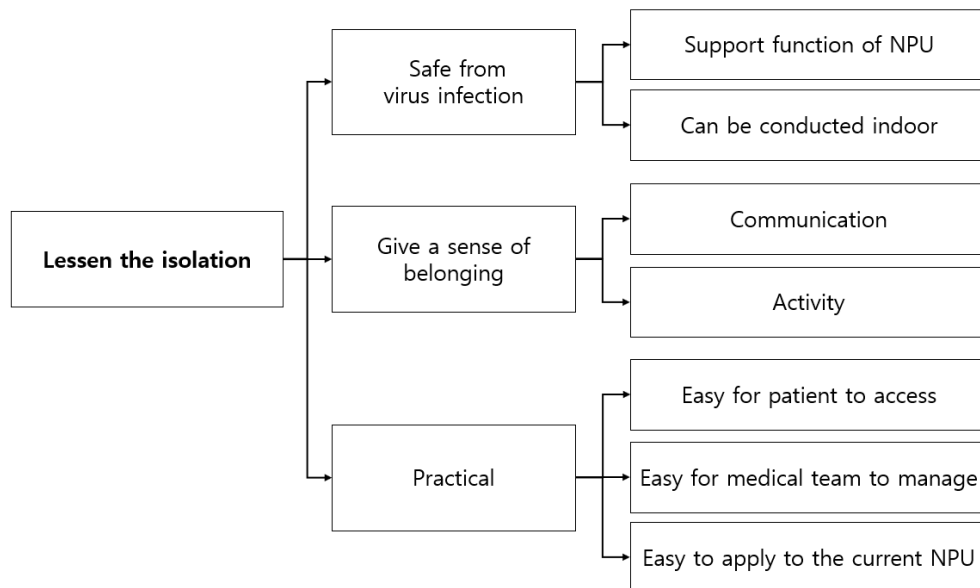
#### **The Cessation of Psychiatric Treatment.**

Psychiatric treatment, which has been regularly performed at existing facilities, is interrupted due to isolation of the sound pressure room. Psychiatric therapy is a key part of the treatment of their mental illness, which is difficult to achieve in isolation, mainly through relationships with people,

including psychiatrists and patients. The discontinuation of treatment is one of the major causes of mental deterioration.

## Design Plan

### Objective Tree



The main objective is to lessen the sense of isolation of the mentally disordered patients in NPU. The three objectives have been set to support the main objective, being safe from virus infections, giving a sense of belonging and being practical. In order to prevent the spread of infectious diseases, our group has agreed that the new alternative needs to support the function of NPU, and should be a design that is available indoors. Since the design should give a sense of belonging, our group agreed that it should be encouraging communication with others, including activities. Also, the design should be practical in many ways. It should be easy for patients to use, and also for medical teams to manage. It should also be easily applicable to current NPU.

### Principal Functions

- Supporting negative pressure:

The revised room still needs to be able to maintain the negative pressure. Even in the new design, negative pressure technology, the primary function of NPU, should not be disturbed.

- Fully managed by medical staffs:

The medical staff, who face the patients every day and know their condition better than anyone, become managers to control the chatting system. They are given full authority in management. The system should be easy to manage.

- Enabling interactions with others:

Since this project is mainly focused on dealing with the sense of isolation caused by a break in communication, the alternatives should enable the patients to have interactions with others in some way.

### Constraints

- The majority of the patients are seniors:

As the statistics above said, the majority of the patients are aged. They might not be able to get familiar with some new designs or technologies that require a high level of education or a complicated usage.

- The patients spend most of the time on the bed:

Due to the disease, many patients may not be able to perform activities that require a lot of energy. It is important to be accessible on the bed and not to strain their health.

### Morphological Chart

| MEANS   | 1   | 2  | 3        | 4          |
|---|---|--|----------|------------|
| FUNCTION  |   |  |          |            |
| Negative pressure (still working in a revised design) | NPU function is working                                 | ...  | ...      | ...        |
| Fully managed by medical staffs                       | The medical team should manage the patient face-to-face | Can be managed automatically using the program | ...      | ...        |
| Must have a way of an interaction among people        | Face-to-face  | Voice  | Chatting | Video call |

### Design Alternatives

#### Alternatives

##### Zoom.

*Details.* NPU's patients can communicate with each other via Zoom, allowing them to make video calls with many people. NPU patients will participate in group activities such as group conversation and mental therapy once or twice a day through Zoom. This group activity through Zoom helps communicate between patients and relieves the isolation they feel. Zoom activities are designed by medical staff, and each group is assigned to lead the activity.

- Advantages
  - Easy to express emotions
  - Free from virus infection
  - Easy for the medical team to manage
- Disadvantages
  - Lack of concentration
  - Feel burden on showing own face
  - Have constraints on time

### **Chatting.**

*Details.* Develop a new messaging platform for quarantined patients around the country. Patients can communicate with each other through chatting. They use a chatting system only for patients with mental illnesses, so they talk to someone who has similar concerns or problems, and gain sympathy from others. Electronic devices for chatting will be provided to enable the patients to access easily.

- Advantages
  - Does not have constraints on time
  - Can chat anytime
  - Easy to get bond of sympathy
- Disadvantages
  - Have difficulties on expressing feelings

### **Advanced Interphone.**

*Details.* Enhance the function of the interphone in a room to allow the patients to talk to someone in another room.

- Advantages
  - Physically comfortable
  - Easy to communicate
  - Low cost
- Disadvantages
  - Could be hard to communicate
  - Communication is limited because it can only be communicated with patients in the hospital.



### Metrics for Choosing Among the Alternatives

| Objective              | 0                                | 1                                     | 2                               | 3                               | 4                               |
|------------------------|----------------------------------|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <b>Function of NPU</b> | NPU function is not working.     | ...                                   | ...                             | ...                             | NPU function is working.        |
| <b>Communication</b>   | Not able to communicate          | Message                               | Voice                           | Video call                      | Face-to-face                    |
| <b>Activity</b>        | No activity                      | Activity alone                        | Man-to-man activity             | Activity with others            | ...                             |
| <b>Easy to access</b>  | Only experts can access          | Can be only used with someone's help. | Can be used alone.              | Be automatically available      | ...                             |
| <b>Easy to manage</b>  | 15 patient per one medical staff | 10 patient per one medical staff      | 7 patient per one medical staff | 5 patient per one medical staff | 1 patient per one medical staff |
| <b>Easy to apply</b>   | Need to rebuilt.                 | Add the system and redesign.          | Redesign                        | Add the system.                 | ...                             |

|                            | Function of NPU | Communication | Activity | Easy to access | Easy to manage | Easy to apply | Total |
|----------------------------|-----------------|---------------|----------|----------------|----------------|---------------|-------|
| <b>Zoom</b>                | 4               | 3             | 3        | 1              | 1              | 3             | 15    |
| <b>Chatting</b>            | 4               | 1             | 2        | 2              | 3              | 3             | 16    |
| <b>Advanced Interphone</b> | 4               | 2             | 3        | 1              | 1              | 3             | 14    |

### Final Design

#### Detailed Description of Chosen Alternative – “Chatting”

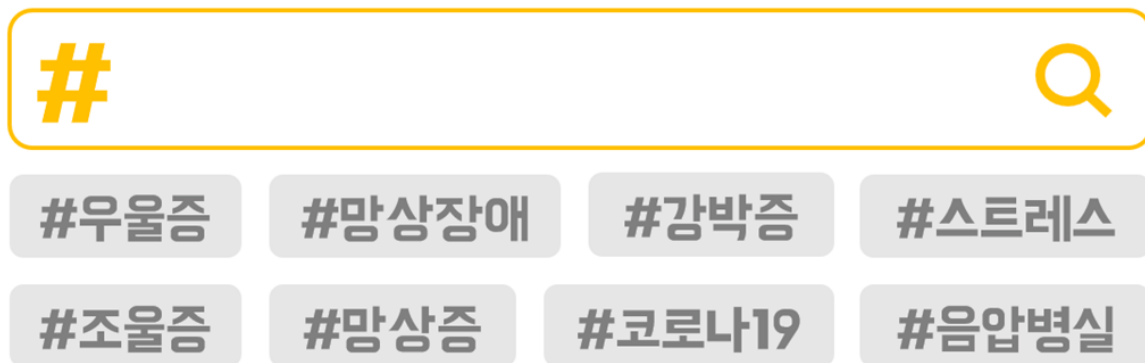
##### Proof of Concept

Chat platforms, such as KaKaotalk, Line and Telegram, are currently available in the market, so the program can be easily implemented. Also some existing functions of the chatting application, such as hashtags, can be modified and supplemented to make them better for the mentally ill in NPU.

##### Design Description.

- **Group the Patients with Similar Symptoms:**

Develop a new messaging platform for quarantined patients around the country. All of the patients are grouped into a chatting room with other patients with similar symptoms. They can enter the chatting room after choosing whether they are going to use their real name, or be anonymous.



- **Medical Teams Manage the System:**

Medical teams are fully in charge of the control of the chatting system. The permission for entering a particular chatting room is only given by the medical team. Just like the KaKaotalk open chatting room.

- **4 Ways to Input Messages:**

Since most patients are aged and are mentally disabled, the current input method, which is typing, has lots of limitations to the patients. They might not be able to use the keyboard. So, the chatting application provides four different ways to input messages, typing, writing, voice recording and shortcuts. Patients can choose the way they feel comfortable.

- ☐ Typing keyboard - Patients who are familiar with typing can use the keyboard.



- ☐ Capturing handwriting - Patients who are unable to type can write their messages. However, their handwriting could be hard to be recognized by the program. So, we decided to capture the handwriting, instead of having a character recognition program. After they write messages and push the 'send' button, it automatically captures the handwriting, and sends the image. For this handwriting, a large-screen tablet and tablet pen will be provided to make it easier for patients to write messages on the screen. This will

help patients express their opinions by drawing and sending pictures, not just messages.



- ❑ Voice recording - Voice recording is for those who are illiterate. Also, since most of the mentally ill are elderly, messages in the form of handwriting and voice recording are more comfortable than messages in the form of keyboards. Voice recording, which does not require any input, also helps them communicate more easily because most patients are lying in bed all day. Therefore, patients can feel more familiar with the other person because the voice is embedded in the human voice and intonation rather than the textual characters.



- ❑ Shortcuts with Emojis - These shortcuts allow the patients easier to communicate with emojis. The emojis store each message by default, and patients can specify these messages themselves. Therefore, patients can save their own words or messages that are often said, but they can send messages quickly through emojis when needed.



### Predicted Outcome

Our group has established a chatting system for patients who are mentally ill in NPU. This system allows patients to chat with people with similar types of mental diseases. With this messaging platform, patients relieve their sense of disconnection and isolation through communication with other patients, giving them a positive psychological impact. In addition, patients who lack experiences in relationships with others learn how to relate with others by communicating with patients similar to the situation. Furthermore, patients learn how to express their feelings in text, or in pictures or voices, and learn how to express their symptoms and intentions clearly in words. Improvement in expression helps the medical team to provide more accurate treatment.

### Design Evaluation

#### Consider of Constraints

1) Most mentally ill people who use NPU are elderly. These elderly patients find systems that require high levels of education or complex use difficult. Therefore, we have chosen a chatting system as the final alternative, which does not require a high level of education and complexity during usage. We added not only a basic keyboard method for sending messages but also a voice recording method and handwriting format for older people who may not be unfamiliar with the keyboards. In addition, considering the difficulty of using small screens for older people, we selected electronic devices to distribute tablets that can see large screens.

2) Patients who use NPU spend most of their time in bed. Therefore, we have chosen a chat system as a final alternative which is possible with little movements. This chat system allows patients to chat while lying in bed, and if it is difficult to type on the keyboard, they can communicate with the voice recording system.

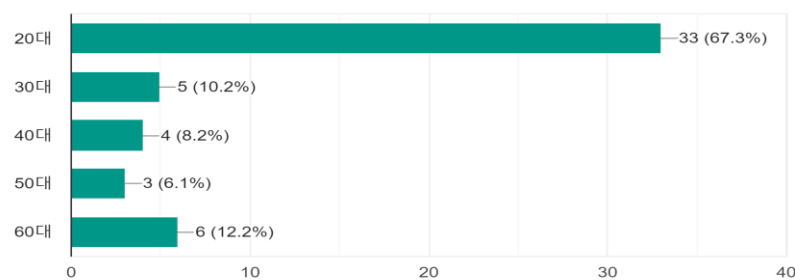
### How Well Design Meets the Objectives

The chatting system has no effect on the function of the NPU, which is keeping negative pressure for preventing the spread of the diseases. It enables the patients to actively participate in communication with each other indoors, without meeting face to face. The design is expected to provide the patients a sense of belonging in order to resolve the main objective, lessening the sense of isolation. These chat systems are designed to be more accessible to patients through hospital-supplied electronic devices, easier to manage, and readily apply to current NPU. Thus, our designed chat system is still safe from spreading infectious diseases, and is practical while giving patients a sense of belonging, eventually eliminating the isolation of mentally ill people in NPU.

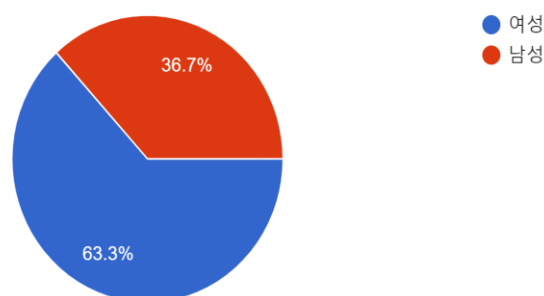
### Survey

#### Questions.

Age (나이)  
응답 49개



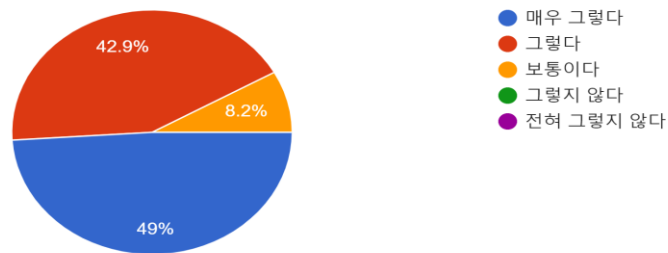
Gender (성별)  
응답 49개



The total number of respondents to the questionnaire was 49, with 31 females and 18 males. 67.3% of the respondents were in their 20s, while the rest of the respondents were in their 60s, 30s, 40s and 50s with 12.2%, 10.2%, 8.2%, and 6.1%, respectively.

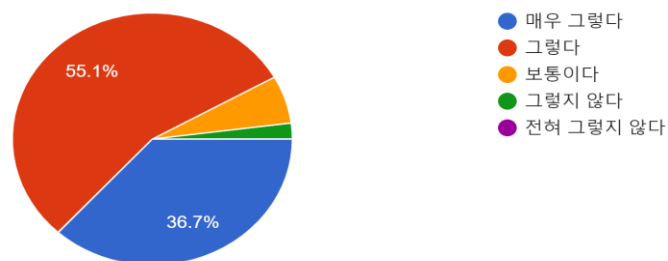
고립감이 정서적 불안정을 야기한다고 생각하십니까?

응답 49개



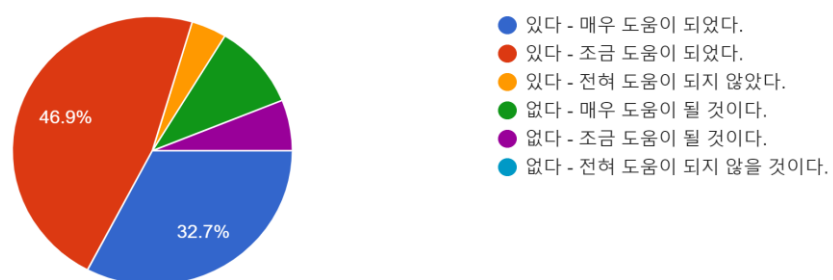
타인과의 관계를 형성하는 것이 고립감을 해결하는데 효과적이라 생각하십니까?

응답 49개



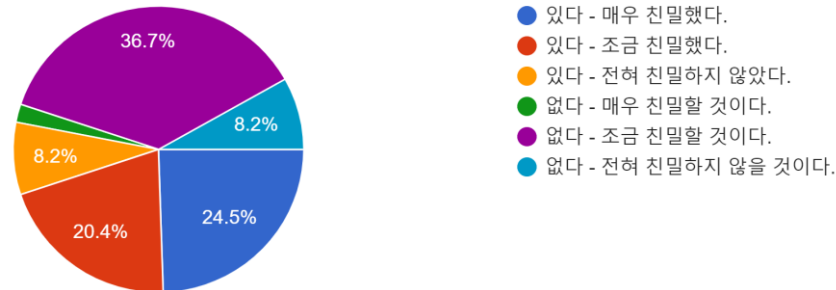
나와 같은 어려움을 겪은 타인과 소통하며 유대감을 쌓은 경험이 있습니까? 있다면 그 경험이 어려움을 극복하는데 도움이 되었습니까? 경험이 없다면 어떻게 예상하십니까?

응답 49개



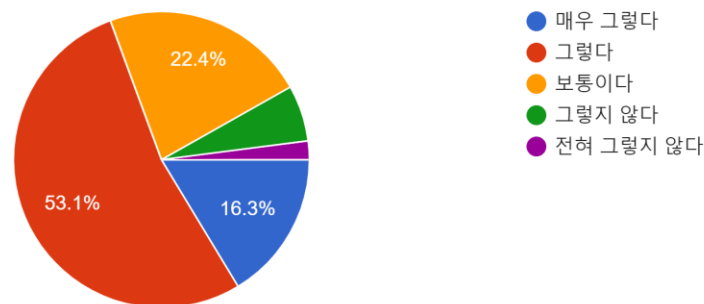
타인(일면식이 없는 사람)과 SNS 상으로 연락하며 유대감을 쌓은 경험이 있습니까? 있다면 그 유대감의 정도는 어느 정도였습니까? 없다면 어떻게 예상하십니까?

응답 49개



일면식은 없지만 같은 어려움을 가진 타인과의 관계를 형성하는 것이 고립감을 해소하는데 효과적이라 생각하십니까?

응답 49개



In the first question, about 90 percent of people answered that isolation causes emotional instability, with very yes (49 percent) and yes (42.9 percent), respectively. This shows that most people experience emotional anxiety due to isolation from society. In addition, most people responded that isolation is effectively resolved by forming a relationship with others, with very yes (36.7%) and yes (55.1%) respectively. Finally, most people said that their relationship with people with similar difficulties and problems helped them more relieve the sense of isolation. This shows that people think communication with people who have similar problems and difficulties help them to solve their isolation rather than those who are in opposite situations.

### Feedback.

To make this positive effect work for people with mental illness other than ordinary people, the survey asked for feedback for developing a chat system to alleviate mental illness in NPU. Some helpful feedback has been collected.

- 1) Most of the mentally ill are the elderly, they need to teach the elderly how to use the chatting

system well and pay attention to the spread of the devices.

- 2) There are also people who make insulting or inappropriate remarks in an anonymous system. Manager needs a way to control these people.
- 3) It is necessary to censor messages so that the messages do not touch each other's trauma and also not be posted on the platform.

### How This Design Can Get Better

#### Educate on How to Use.

The medical team provides relevant training before using the message platform system. From the basic information of sending a message to communicating with patients with the same symptoms through hashtags, the medical staff answers the relevant questions continuously afterwards. In addition, the device supply is carried out in the form of renting a tablet at the hospital and returning it when discharged.

#### Counting Reporting from the Users.

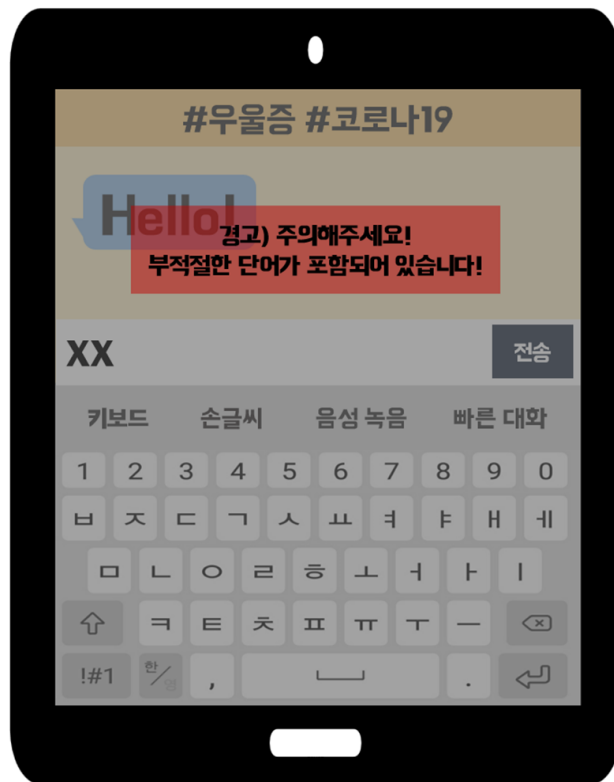
Report accumulation system is included in the corresponding message platform system. If any types of reports, such as malicious comments, accumulate more than three times, the hospital that manages the system limits the problematic patient from using the message platform. Additional training will then be provided, and under the judgment of the medical team, the patient will or will not use the message platform again.



#### Automatic Censorship.

Basically, the message platform system automatically checks words that are inappropriate or that can cause trauma. Including swear words and sentences that are assumed to cause trauma to the patient are specified as taboo words in the system so that messages cannot be sent.





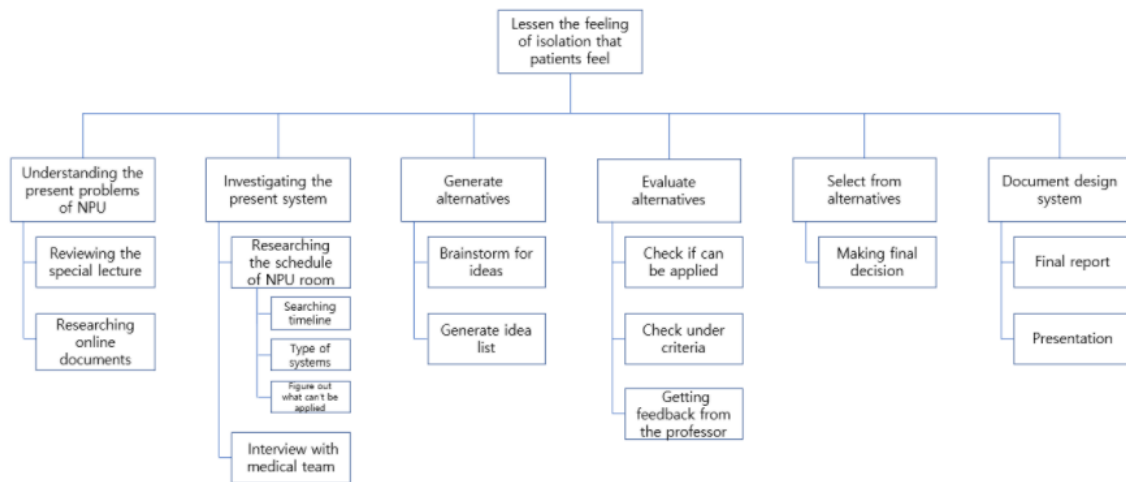
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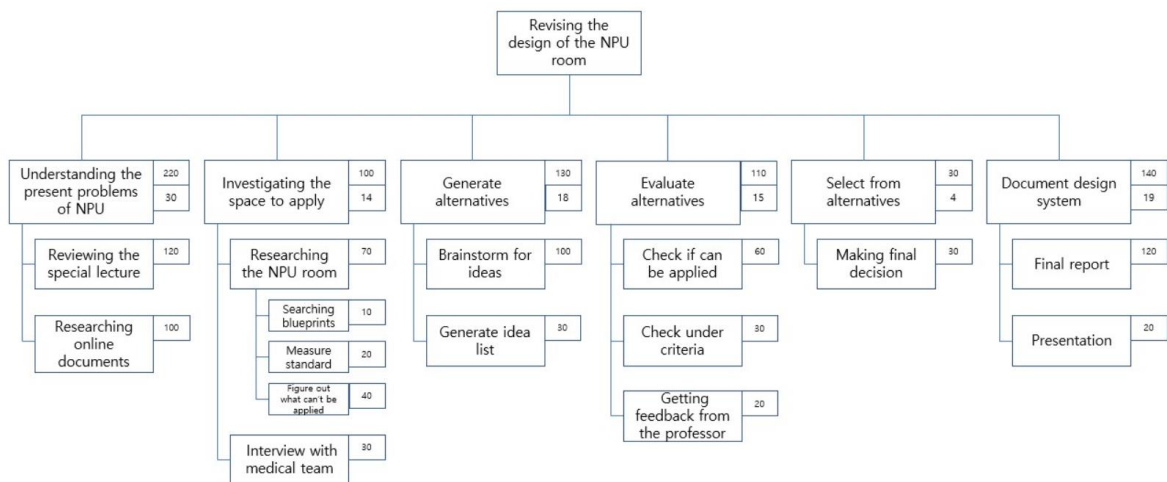
Song, M.S. (2020.09.22) "코로나19 환자 중 30%가 우울감 등으로 정신과 진단 받아", 세계일보. Retrieved September 22, from <https://n.news.naver.com/article/022/0003505767>

## Appendix

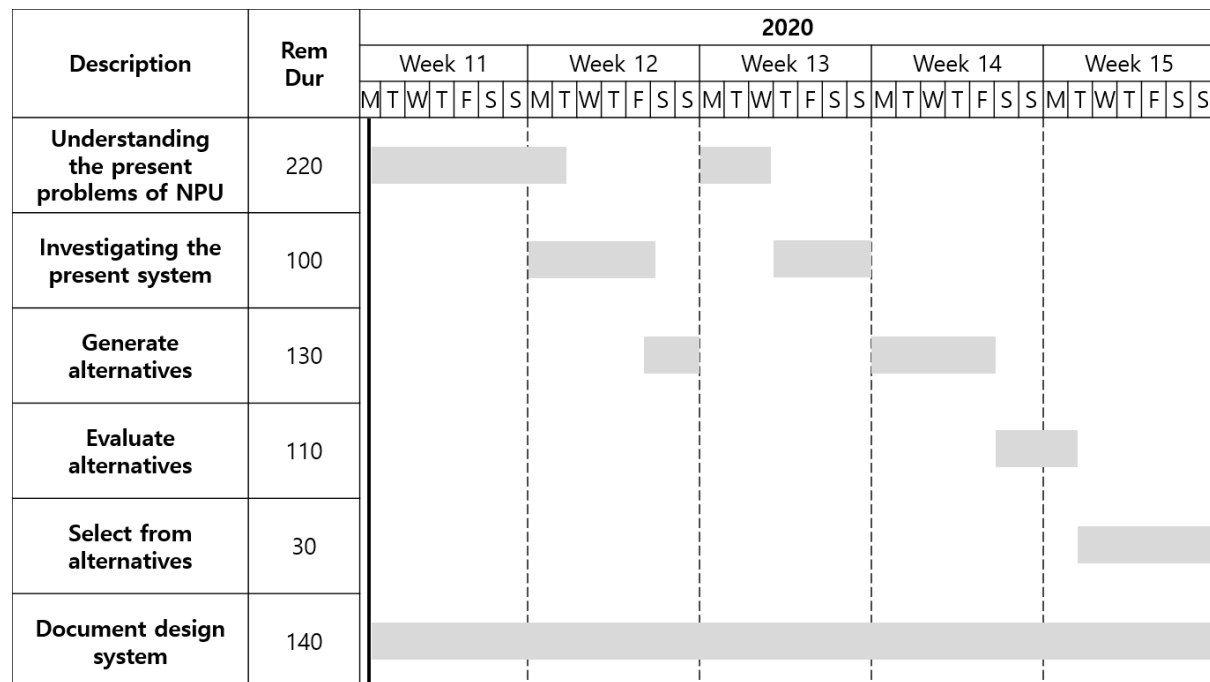
### WBS (Work Breakdown Structure)



### PCM (Percent Complete Matrix)



### Gant Chart



Our group formed the Gant chart based on WBS(Work Breakdown Structure) and PCM(Percent Complete Matrix). We proceeded in an order of understanding the present problems of NPU, investigating the present system, generating alternatives, evaluating alternatives, and selecting from alternatives. We spent most of our time in understanding the present problems of NPU, because we thought it was most important to understand and identify the problem statements. We also felt that there was a problem in selecting the final alternative among the alternatives in week 12, because we did not understand the problem state accurately. Therefore, we restarted the project at week 13, and we rechecked the problem statements accurately and then proceeded the project design. The document design system was implemented throughout the whole period.

### Role and Contribution

Dongsung Kwon (25%):

- Research
- Presentation
- Final report
- Website management

Junseok Park (25%):

- Research
- Presentation
- Final report
- Website management

Ahhyun Kum (25%):

- Research
- PPT
- Final report
- Website management

Donghee Choi (25%):

- Research
- PPT
- Final report
- Website management