



Labmate

A smart lab companion for graduate students

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Life of a graduate student is tough...



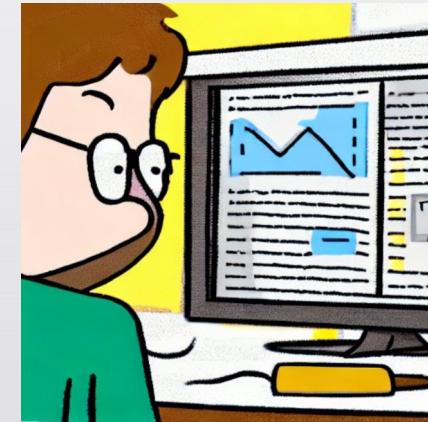
Life of a graduate student is tough...



Meeting with Professor



Writing Papers



Doing Research



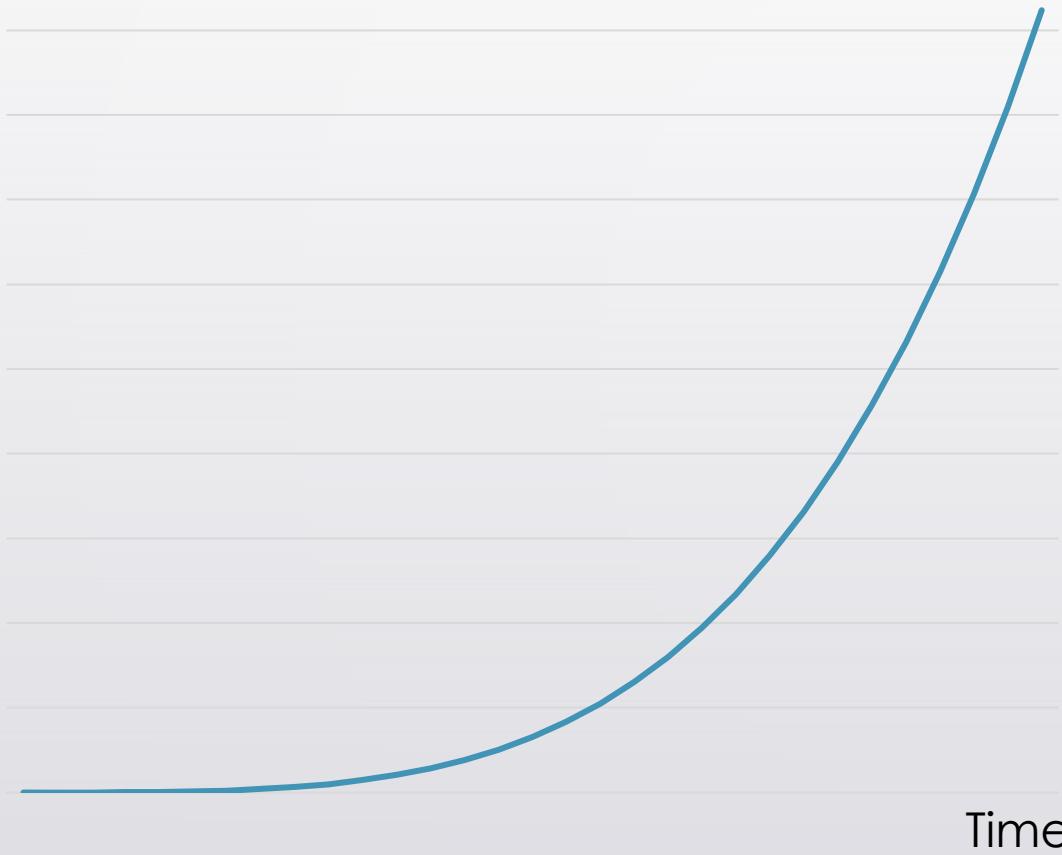
Coursework

“Too much work to do”

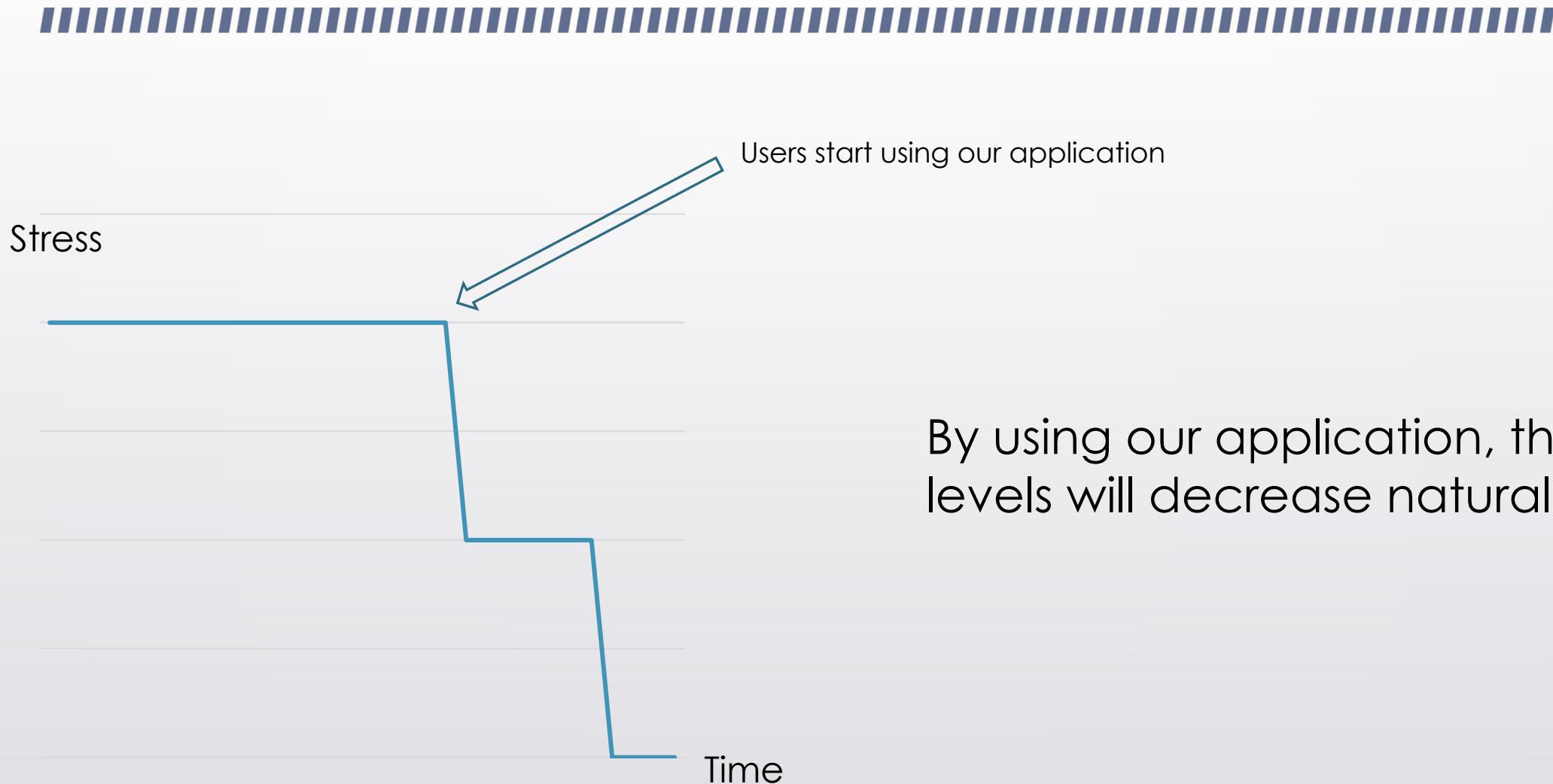
“Wish I could focus solely on my research”



Stress



The stress rate increases exponentially as time goes on





Functions of our application

1. Monitoring GPU usage on lab server
2. Meal queue, seating availability checker
3. Meal recommendation

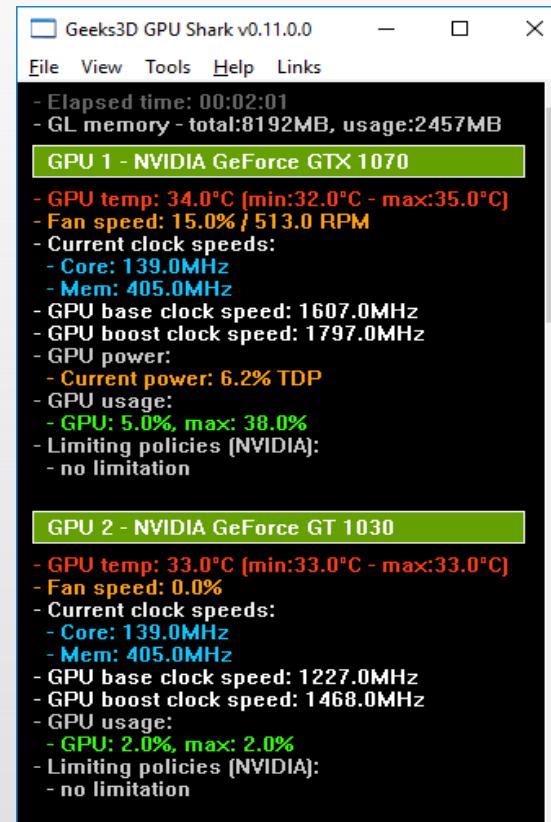


Function 1: GPU server usage monitor

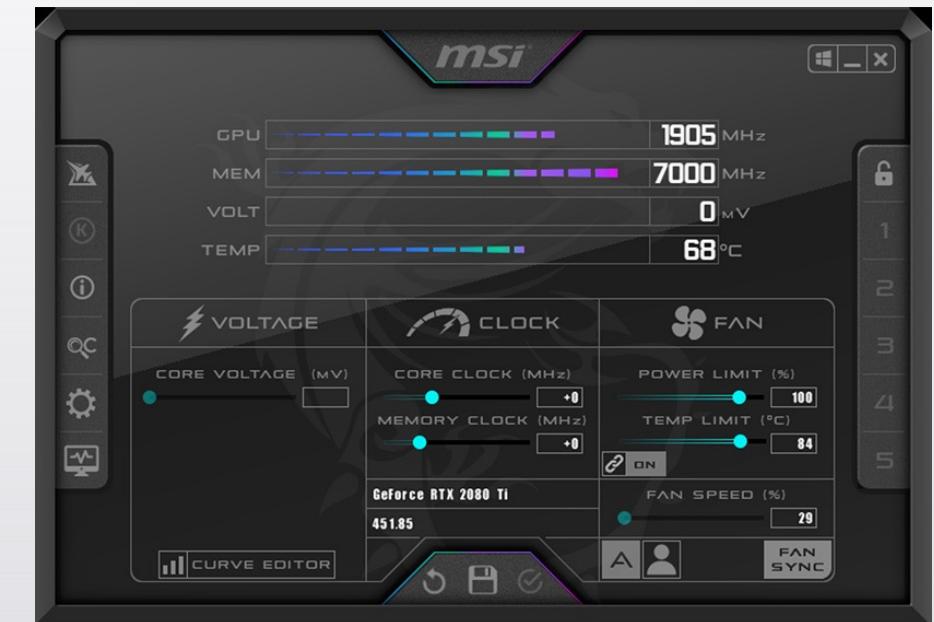
Monitoring GPU usage on lab server – existing solutions

```
NVIDIA-SMI 410.79      Driver Version: 410.79      CUDA Version: 10.0
GPU Name Persistence-M| Bus-Id Disp.A | Volatile Uncorr. ECC
Fan Temp Perf Pwr:Usage/Cap| Memory-Usage | GPU-Util Compute M.
+-----+-----+-----+
| 0  TITAN Xp        Off | 00000000:01:00.0 Off |           N/A
| 54C 54C P2    ERR! / 250W | 1861MiB / 12194MiB | 0% Default
+-----+-----+-----+
| 1  TITAN Xp        Off | 00000000:02:00.0 Off |           N/A
| 50% 69C P2    74W / 250W | 11097MiB / 12196MiB | 0% Default
+-----+-----+-----+
| 2  TITAN Xp        Off | 00000000:05:00.0 Off |           N/A
| 62% 81C P2    86W / 250W | 11299MiB / 12196MiB | 0% Default
+-----+-----+-----+
Processes:
GPU PID Type Process name          GPU Memory Usage
          PID      Type
+-----+-----+
| 0  1535  C  -          617MiB
| 0  17875 C  -          617MiB
| 0  23889 C  -          617MiB
+-----+
```

Nvidia-smi



GPU Shark



MSI Afterburner

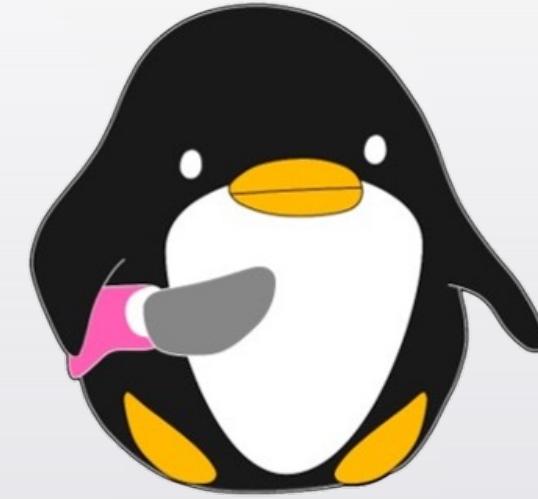
Monitoring GPU usage on lab server – **limitations**



Monitoring GPU usage on lab server – **limitations**



**WINDOWS
ONLY**



**linux is the
only option**



Monitoring GPU usage on lab server – **our solution**



Server 1



Server 2



Server 3

Monitoring GPU usage on lab server – **expected challenges & solutions**

Difficulty 1: Collecting data from multiple servers

Solution:

Use Ray's built-in support for distributed systems to gather GPU information from each server.



An open-source, distributed library for building flexible parallel, and distributed applications.

Monitoring GPU usage on lab server – **expected challenges & solutions**

Difficulty 2: Real-time data updates and synchronization

Solution:

1. Implement a mechanism to periodically fetch the latest GPU data from the servers
2. Use a suitable polling interval to balance performance and responsiveness.

Monitoring GPU usage on lab server – **expected challenges & solutions**

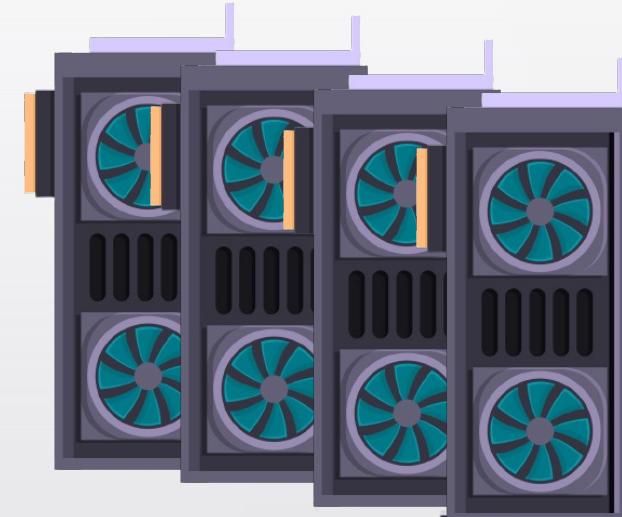
Difficulty 3: Security and access control

Solution:

1. Implement appropriate security measures to protect sensitive GPU data and control access to the monitoring system
2. Configure communication channels, implement authentication and authorization.
3. Implement monitoring for potential security threats

Monitoring GPU usage on lab server – **evaluation strategy**

```
+-----+  
| NVIDIA-SMI 381.09      Driver Version: 381.09 |  
+-----+  
| GPU  Name     Persistence-MI Bus-Id     Disp.A  | Volatile Uncorr. ECC |  
| Fan  Temp   Perf  Pwr:Usage/Cap| Memory-Usage | GPU-Util Compute M. |  
+-----+  
| 0  TITAN Xp        Off  | 0000:02:00.0    Off  |          N/A |  
| 23% 42C   P2    58W / 250W | 10555MiB / 12189MiB | 0%     Default |  
+-----+  
| 1  TITAN Xp        Off  | 0000:03:00.0    Off  |          N/A |  
| 25% 44C   P2    60W / 250W | 10209MiB / 12189MiB | 0%     Default |  
+-----+  
| 2  TITAN Xp        Off  | 0000:02:00.0    Off  |          N/A |  
| 23% 39C   P2    60W / 250W | 10209MiB / 12189MiB | 0%     Default |  
+-----+  
| 3  TITAN Xp        Off  | 0000:03:00.0    Off  |          N/A |  
| 24% 44C   P2    60W / 250W | 11784MiB / 12189MiB | 0%     Default |  
+-----+  
| Processes:                               GPU Memory |  
| GPU      PID  Type  Process name           Usage    |  
+-----+
```



Sync between actual usage value (result of nvidia-smi) and value on app

User experience (easy UX)

Monitoring GPU usage on lab server – **usage scenario**

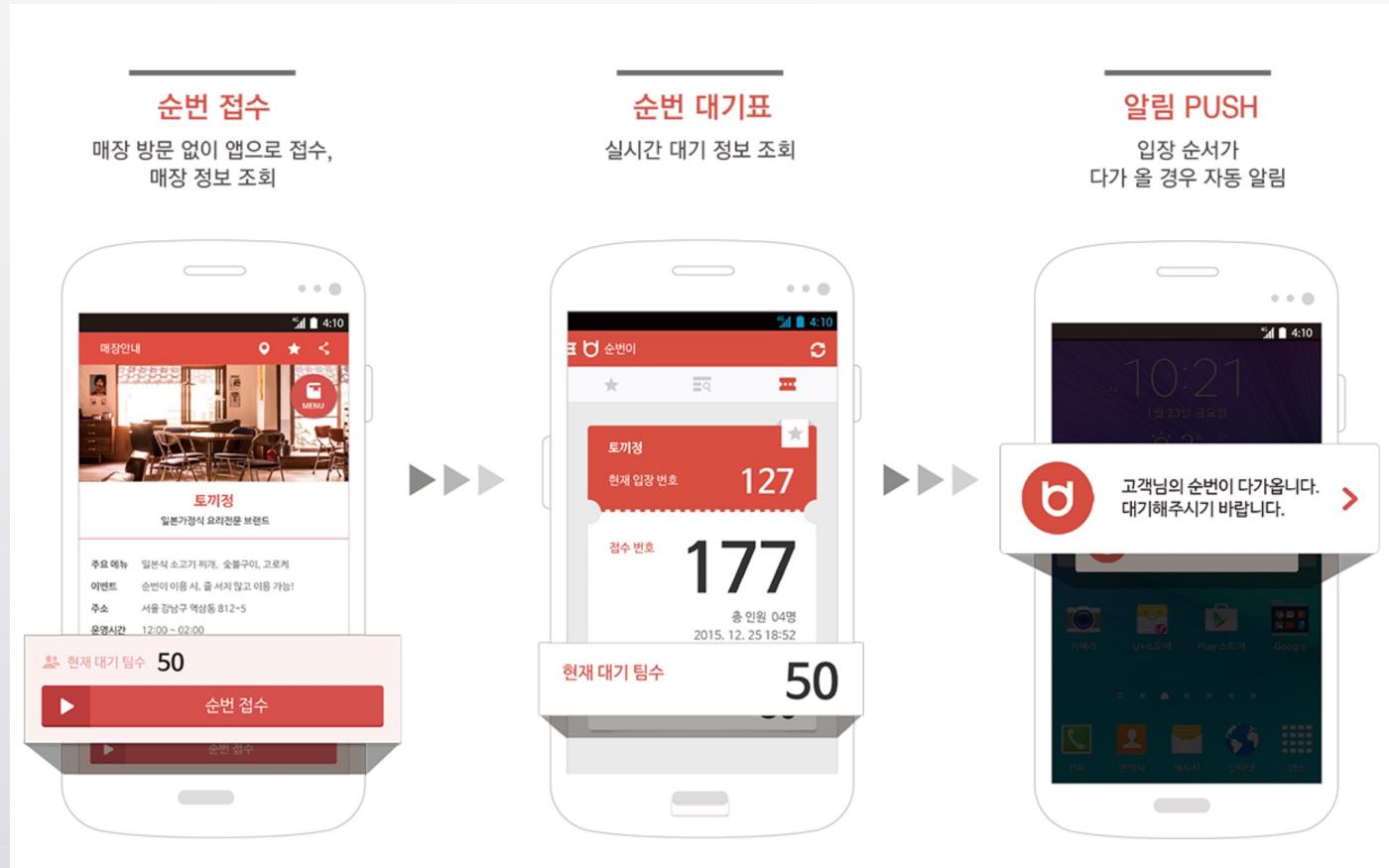


1. Yonwoo needed to use more GPUs to obtain faster results for his paper deadline next week
2. He was assigned only 2 GPUs for himself and was afraid to ask other students if they were using their assigned GPUs
3. He used **Labmate's** GPU activity monitor and verified that some GPUs were not in use
4. There was an agreement with the lab members that anyone with need could use idle GPUs
5. Yonwoo was able to train his model faster and submitted his paper on time



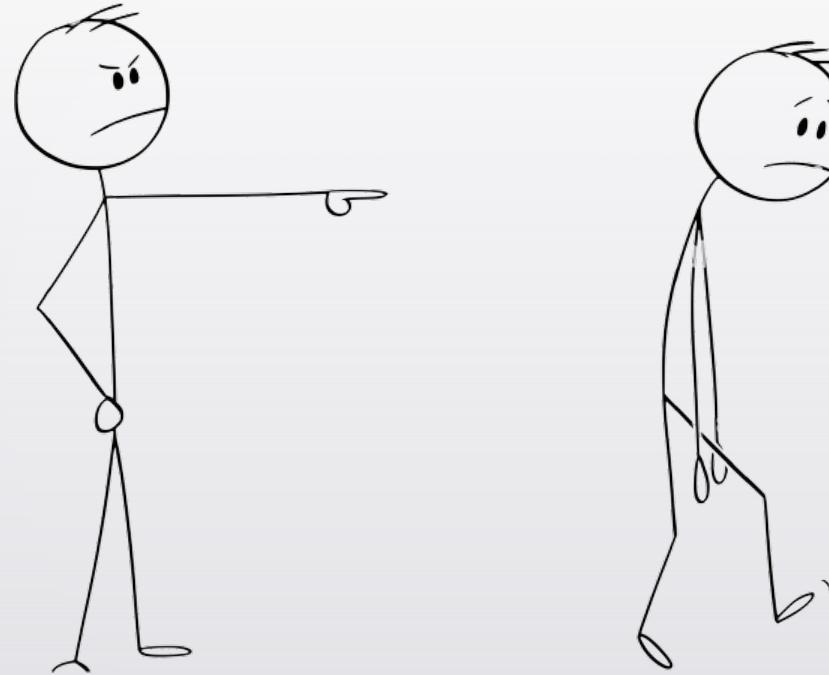
Function 2: Meal queue, seating availability checker

Meal queue, seating availability checker – existing solutions



순번이는?
순번 접수 후
줄을 서지 않아도
내 입장 순서를 알려 주는
스마트한 순번대기 서비스입니다.

Meal queue, seat availability checker – **limitations**



Forcing every user to use the app

Meal queue, seat availability checker – **limitations**



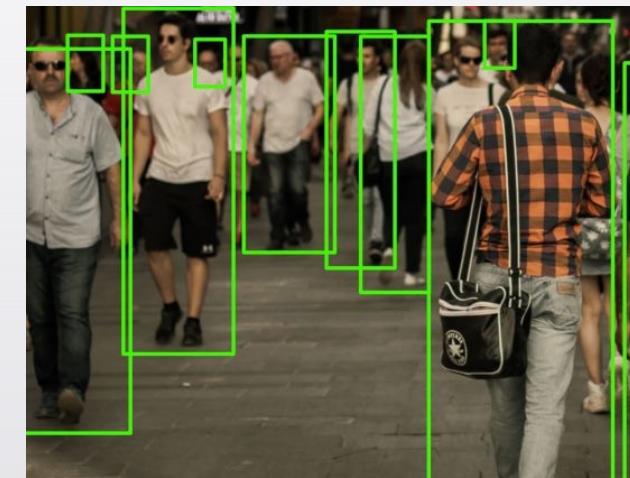
Doesn't take account of people picking up food



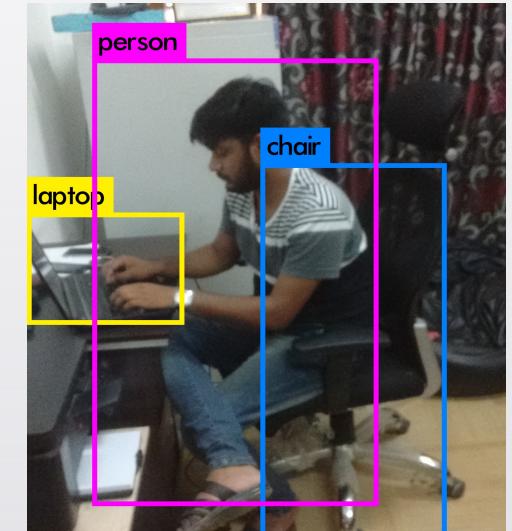
Meal queue, seat availability checker – **our solution**



Sensors (cameras)

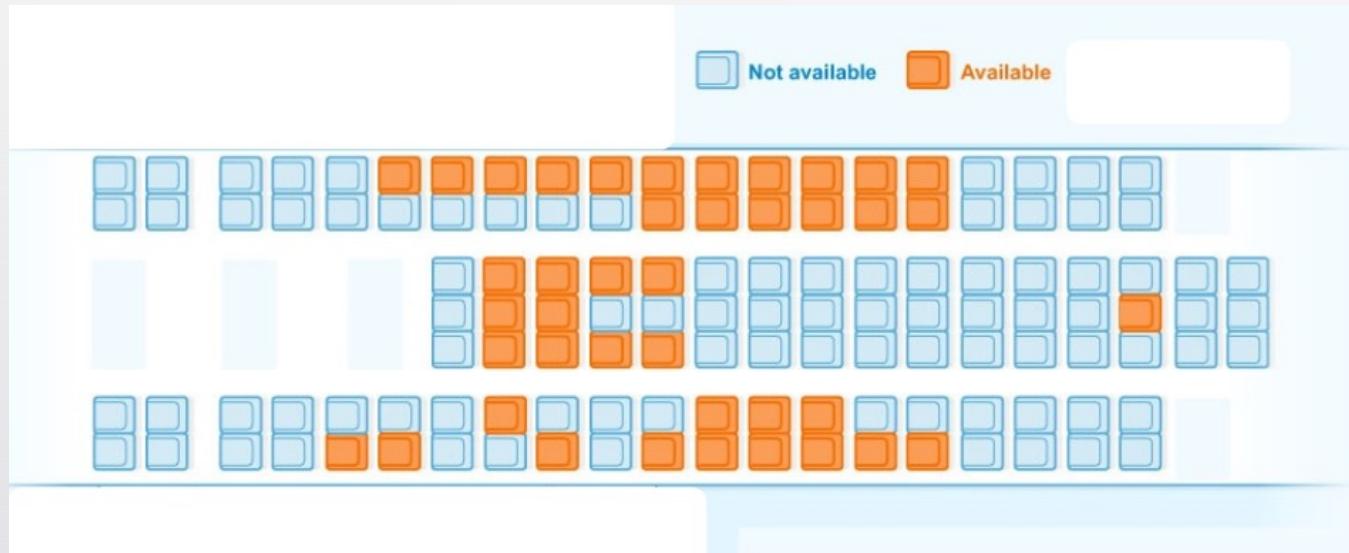


Vision - Human Object Detection

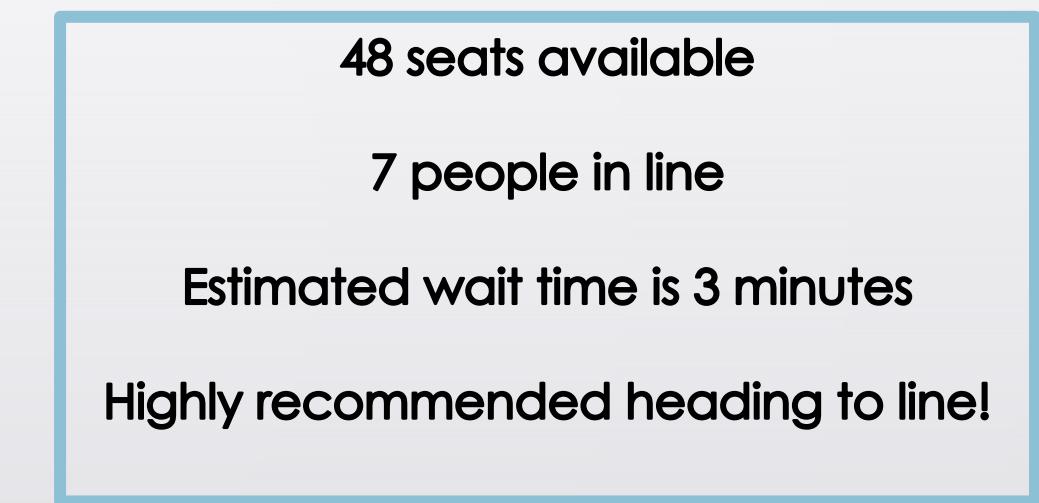




Meal queue, seat availability checker – **our solution**



Output – Seatplan



Output – Alert



Meal queue, seat availability– **expected challenges & solutions**

Difficulty 1: Accurate Human Detection

Solution:

1. Test various deep learning models such as YOLO, Faster R-CNN which are pretrained on large datasets and achieve high accuracy in detecting humans.



Meal queue, seat availability– **expected challenges & solutions**

Difficulty 2: Reliable empty seat detection

Solution:

1. Use template matching, feature matching or deep learning-based object detection.
2. Access to large chair dataset with various seating types, arrangements, and lighting conditions.

Meal queue, seat availability– **expected challenges & solutions**

Difficulty 3: Privacy Issues

Solution:

1. Anonymizing or blurring faces when storing captured data

Meal queue, seat availability– **evaluation strategies**



1. Number of human, chair detection accuracy
2. Detection, classification speed
3. User experience (easy UX)

Meal queue, seat availability – usage scenario

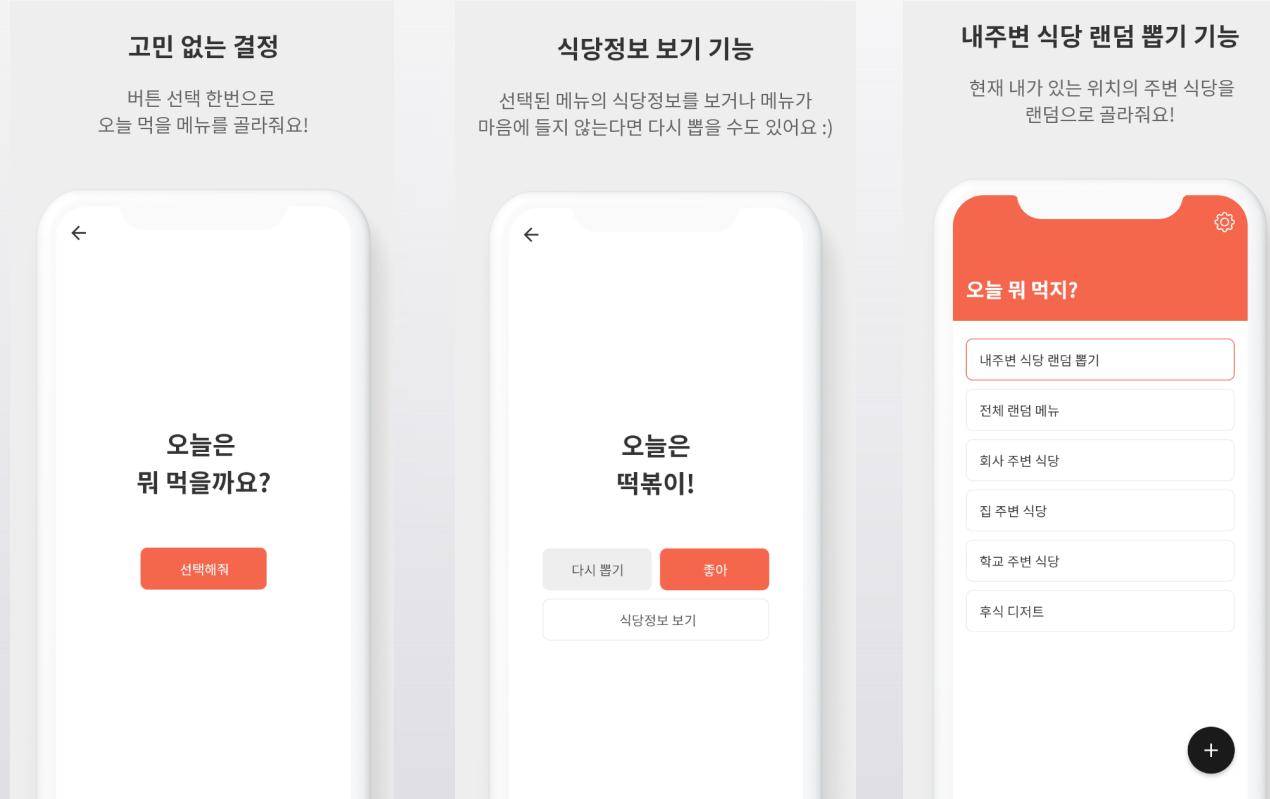


1. Yonwoo and 4 other friends was hungry so he decided to turn on **Labmate's** Meal queue function.
2. Unfortunately, there were not any seats that 5 people could sit next to each other.
3. After a couple of more minutes, Yonwoo turned the app again and verified that the waitime was reasonable, and there were multiple spaces for 5 students.
4. Yonwoo and his friends headed off to the cafeteria and had lunch in a breeze.



Function 3: Meal Recommender System

Meal recommendation- existing solutions



오늘 뭐 먹지? - 식당, 메뉴 선택장애,
결정장애 해



Meal recommendation– limitations

```
In [1]: import random  
a=random.randint(1,10)  
print(a)
```



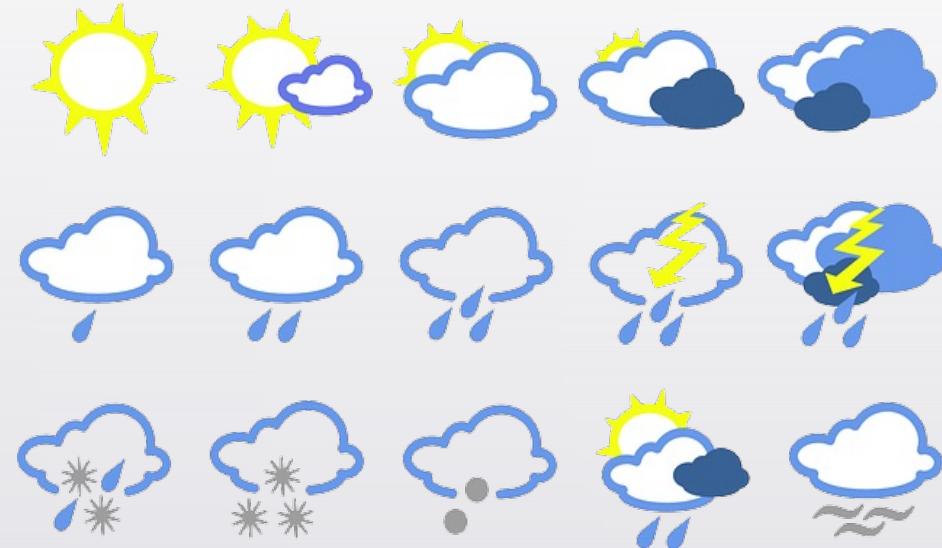
Do not take into account user diet and many other factors

Meal recommendation– **limitations**



No grouping

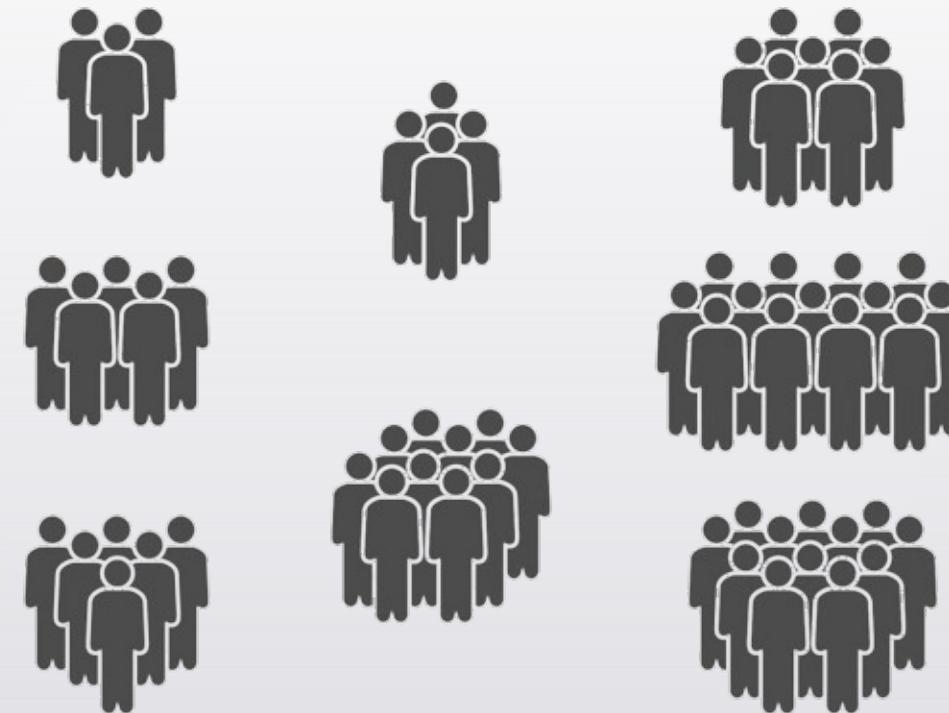
Meal recommendation– our solution



Recommendation based on weather, diet, allergies



Meal recommendation– our solution



Grouping



Meal recommendation– **our solution**



Cycle check

Meal Recommendation – **expected challenges & solutions**

Difficulty 1: Handling complex dietary restrictions and allergies

Solution:

1. Creating a comprehensive database of ingredients, dishes, and their potential allergens to ensure meal recommendations are safe and suitable for all users.
2. Implementing a system to cross-reference users' allergies and dietary preferences with ingredients in recommended dishes.

Meal Recommendation – **expected challenges & solutions**

Difficulty 2: Adapting to changes in weather, diets, and allergies

Solution:

1. Involve periodic data updates and an adaptive recommendation algorithm
2. Create a feedback mechanism that allows users to rate and provide feedback on the recommended meals.

Meal Recommendation – **evaluation strategies**



1. Checking if recommended meal does not relate to group member's allergies
2. Checking if same types of recommendations are not given in a certain time period
3. Checking if the meal is in compliance with the weather
4. Measuring the speed of recommendation
5. User experience (easy UX)

Meal recommendation– usage scenario



1. Yonwoo and his colleagues had a difficult time deciding what menu to order for dinner.
2. They agreed to use the meal recommendation function in **Labmate**.
3. Taking into consideration the rainy weather, the allergies of group members, and diet, the app recommended **부대찌개** (Korean soup) as it met everyone's requirements without triggering any allergies.
4. Thanks to the application taking weather as a consideration to meal recommendation, Yonwoo and his colleagues had a warm, comforting meal suitable for a rainy weather.



Overall project plan

Tasks	Week	4	5	6	7	8	9	10	11	12	13	14	15
Presentation	Present	YW						HY + EM					HY or EM + NI
	PPT	YW						HY + EM					HY or EM + NI
GPU usage monitor	Get familiar with Ray		YW	YW									
	Create development environment				YW	YW	YW						
	Develop distributed application								YW	YW	YW	YW	
Meal queue	Prepare Equipment	HY	HY										
	Test different models			HY	HY								
	Develop detection pipeline					HY	HY		HY	HY	HY	HY	
Meal Recommendor	Gather Data	EM	NI										
	Build/train recommendor system			EM+NI	EM+NI	EM+NI	EM+NI						
	Develop system pipeline								EM+NI	EM+NI	EM+NI	EM+NI	
Regular Meetings			ALL		ALL		ALL			ALL			ALL
App Development	UX/UI Design				YW	EM	YW		HY	YW	YW	ALL	
	Test				EM	HY	EM		NI	HY	NI	ALL	
	Front Development				NI	YW	NI		YW	EM	HY	ALL	

Final Deliverable

GPU usage monitor



Meal queue, seat detector



Meal recommendation



YOLOv5



Based com
approach training
Research User
Information ACM Computer
Technology
Recommender System
recommend



Thanks!
Any Questions?