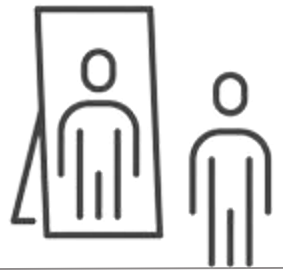
2nd Semester Graduation Project

Smart Mirror for Virtual Fitting



201735894 Choi Hyeongin

201835486 Lee Minseo

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Contents

How can we save time on deciding what to wear everyday?

Let's recommend styling with **Smart Mirror**

- It provides **virtual fitting**
- It can reduce the time to choose or purchase clothes

According to the 'Mobile Shopping Trend Report 2020' released on August 3 by Mobile Research Open Survey,

오프라인 구매 이유

		Gap (vs. 19년)	남성 (382)	여성 (411)	20대 (271)	30대 (257)	40대 (265)
상품을 직접 착용/확인할 수 있어서	76.0	-0.2	73.8	78.1	77.5	74.7	75.8
배송/운반이 빨라서/편리해서	28.4	-3.8	27.7	29.0	31.0	31.1	23.0
편리해서	24.5	+0.6	24.3	24.6	24.7	23.7	24.9
쇼핑경험이 좋아서	18.3	-0.4	19.9	16.8	14.8	17.9	22.3
안전성에 대해 신뢰할 수 있어서	9.1	+2.0	7.6	10.5	12.9	5.8	8.3
고객서비스가 좋아서	8.4	+2.6	9.7	7.3	8.5	9.7	7.2
상품구성이 좋아서	7.6	+1.8	7.1	8.0	6.3	7.4	9.1
가격/가치가 좋아서	6.7	-0.9	5.5	7.8	4.8	7.0	8.3
결제가 편리해서	4.8	-1.2	6.3	3.4	4.1	5.1	5.3
멤버쉽 혜택이 좋아서	4.0	-0.7	4.2	3.9	4.1	2.7	5.3

[Base : 3개월 내 오프라인 채널 구매자, N=793, 순위형 응답(1+2순위), %]

Description

Clothing Recommendation Service

- Musinsa store styling + User’s clothes styling
- Clothing recommendation considering the temperature

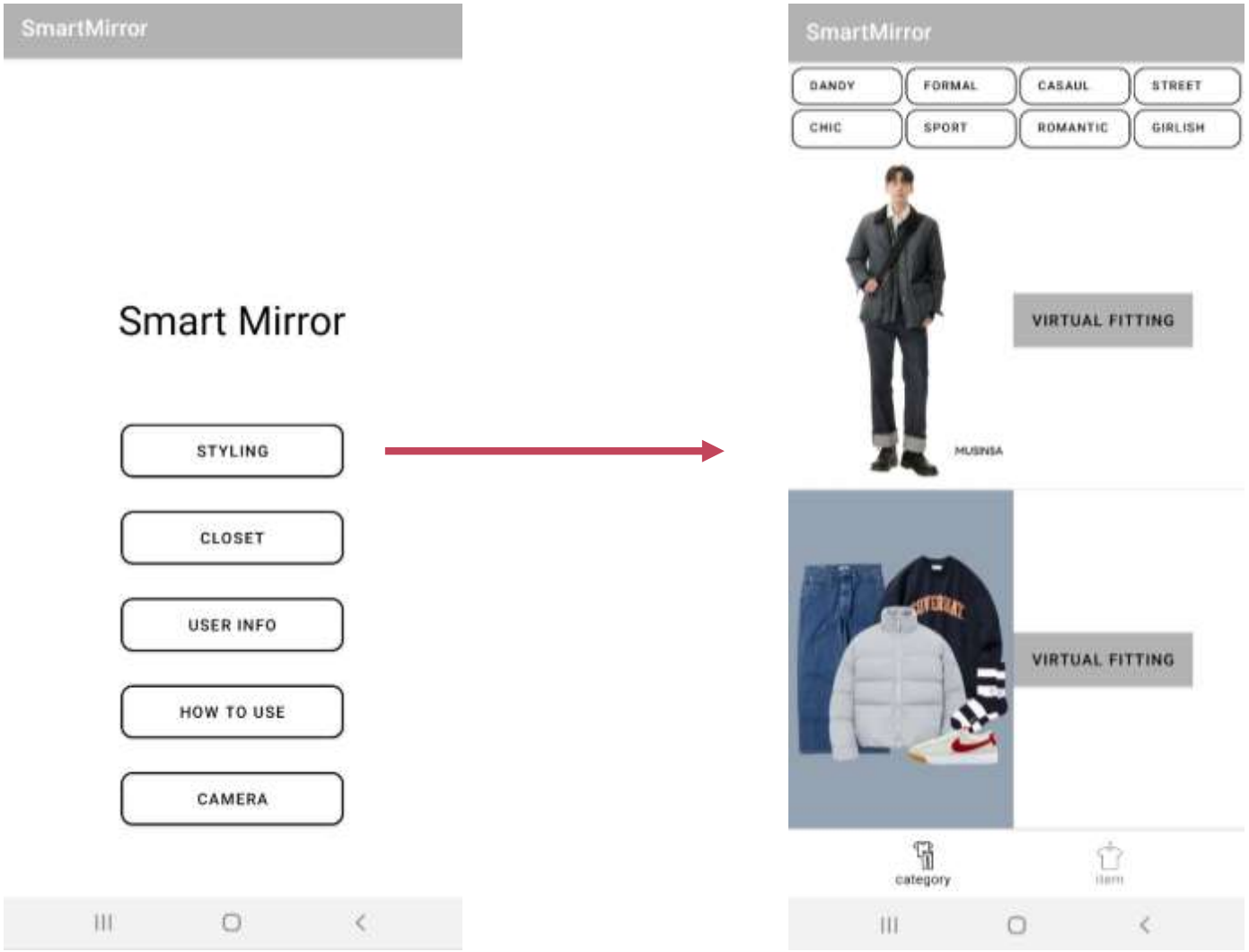
Amount of clothes data: 384 images

Smart Mirror?

- Combines display and mirror
- Provides virtual fitting

Key Features

1. STYLING Button



Key Features

1. STYLING Button

http://52.79.59.24/getData.php?TEMP=7&STYLING=casual

{"Look":[{"ID":"16","Image":"https:#/#/smartmirror-bucket.s3.ap-northeast-2.amazonaws.com#/casual#/styling_11.jpg","Category":"styling","Temp":"7","outerLink":"https:#/#/store.musinsa.com#/app#/goods#/2070932#/0","topLink":"https:#/#/store.musinsa.com#/app#/goods#/685878#/0","bottomLink":"https:#/#/store.musinsa.com#
{"ID":"17","Image":"https:#/#/smartmirror-bucket.s3.ap-northeast-2.amazonaws.com#/casual#/styling_12.jpg","Category":"styling","Temp":"7","outerLink":"https:#/#/store.musinsa.com#/app#/goods#/2211156#/0","topLink":"https:#/#/store.musinsa.com#/app#/goods#/2081723#/0","bottomLink":"https:#/#/store.musinsa.com#
{"ID":"18","Image":"https:#/#/smartmirror-bucket.s3.ap-northeast-2.amazonaws.com#/casual#/styling_13.jpg","Category":"styling","Temp":"7","outerLink":"https:#/#/store.musinsa.com#/app#/goods#/2196442#/0","topLink":"https:#/#/store.musinsa.com#/app#/goods#/2216371#/0","bottomLink":"https:#/#/store.musinsa.com#

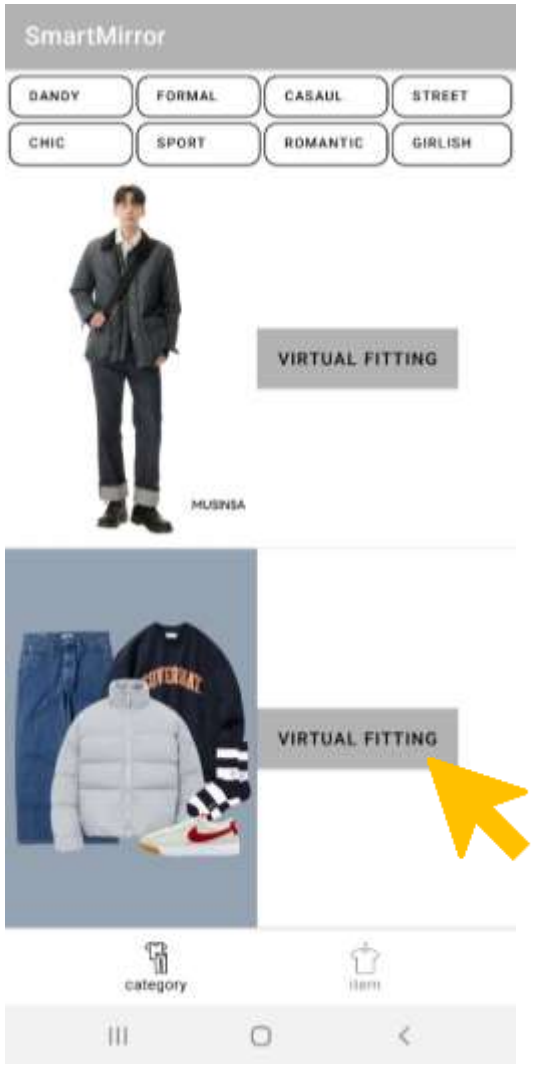
```
E/id:: 16
E/image_url:: https://smartmirror-bucket.s3.ap-northeast-2.amazonaws.com/casual/styling_11.jpg
E/category:: styling
E/temperature_section:: 7
E/outer_link:: https://store.musinsa.com/app/goods/2070932/0
E/top_link:: https://store.musinsa.com/app/goods/685878/0
E/bottom_link:: https://store.musinsa.com/app/goods/1569030/0
```

Detail – Key Features

1. STYLING Button

Key Features

1. STYLING Button




```
Python 3.7.3 (/usr/bin/python3)
>>> %Run socket_android.py

  wait..
  Connected by?! ('192.9.116.235', 65355)
  http://52.79.59.24/virtualFitting.php?STYLING=dandy&ID=1
```

Key Features

1. STYLING Button

VIRTUAL FITTING

Uses haarcascade to distinguish the user's upper and lower body coordinates.

```
cap = cv2.VideoCapture(0) #return 0 or -1

upper_path = 'Downloads/haarcascade_upperbody.xml'
lower_path = 'Downloads/haarcascade_lowerbody.xml'
upperCascade = cv2.CascadeClassifier(upper_path)
lowerCascade = cv2.CascadeClassifier(lower_path)
```

```
lowerRect = lowerCascade.detectMultiScale(imageGray, scaleFactor=1.3, minNeighbors=1, minSize=(1,1))
temp = []
temp2 = []
for x,y,w,h in lowerRect:
    if w>100:
        print("lower: %d, %d, %d, %d"%(x,y,w,h))
        temp = [x,y,w,h]
        roi_color = img[y:y + h, x:x + w]
        upperRect = upperCascade.detectMultiScale(imageGray, scaleFactor=1.3, minNeighbors=1, minSize=(1, 1))
        for lx,ly,lw,lh in upperRect:
            if lw>100 and lx<350:
                print("upper: %d, %d, %d, %d"%(lx,ly,lw,lh))
                ly = 0
                roi_color_u = img[ly:ly + lh, lx:lx + lw]
                temp2=[lx,ly,lw,lh]
```

Key Features

2. CAMERA Button

Take a picture of the user's outfit

↓

Remove background

↓

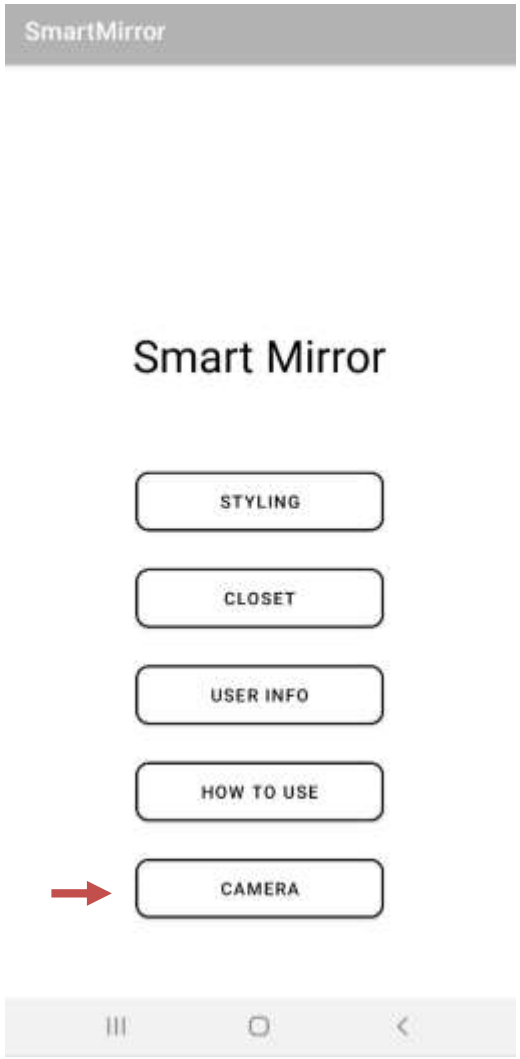
Separate upper and lower body

↓

Use CNN models to upload database

CNN model

bottom_categories.h5
bottom_fit.h5
bottom_length.h5
outer_categories.h5
print.h5
sleeve_length.h5
top_categories.h5



Key Features

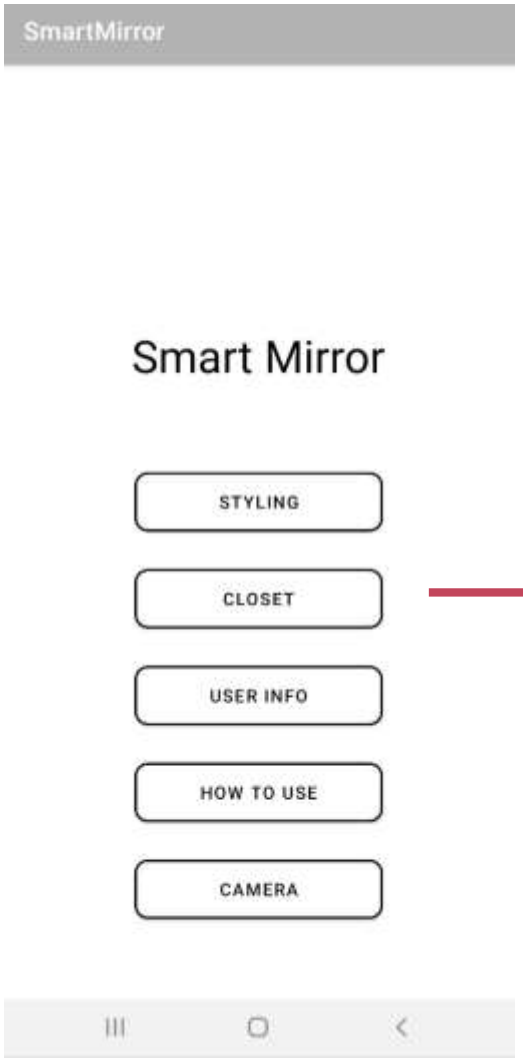
2. CAMERA Button

Remove background

- Edge detection using a structured forest ML model to do edge detection
- Get an approximate contour of the object
- Use OpenCV’s GrabCut algorithm to get a more accurate contour

Key Features

3. CLOSET Button



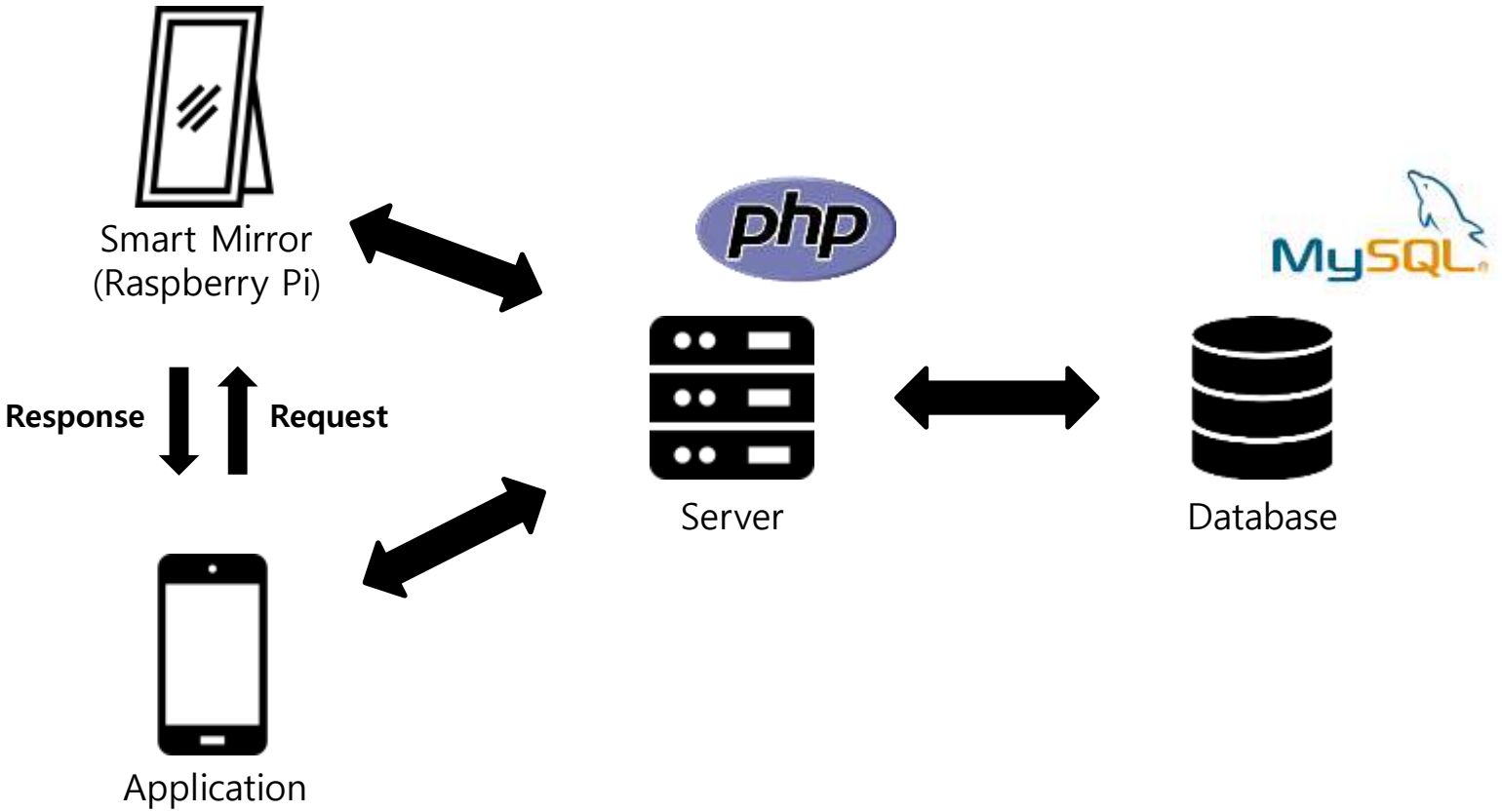
3. CLOSET Button

Recommendation clothes

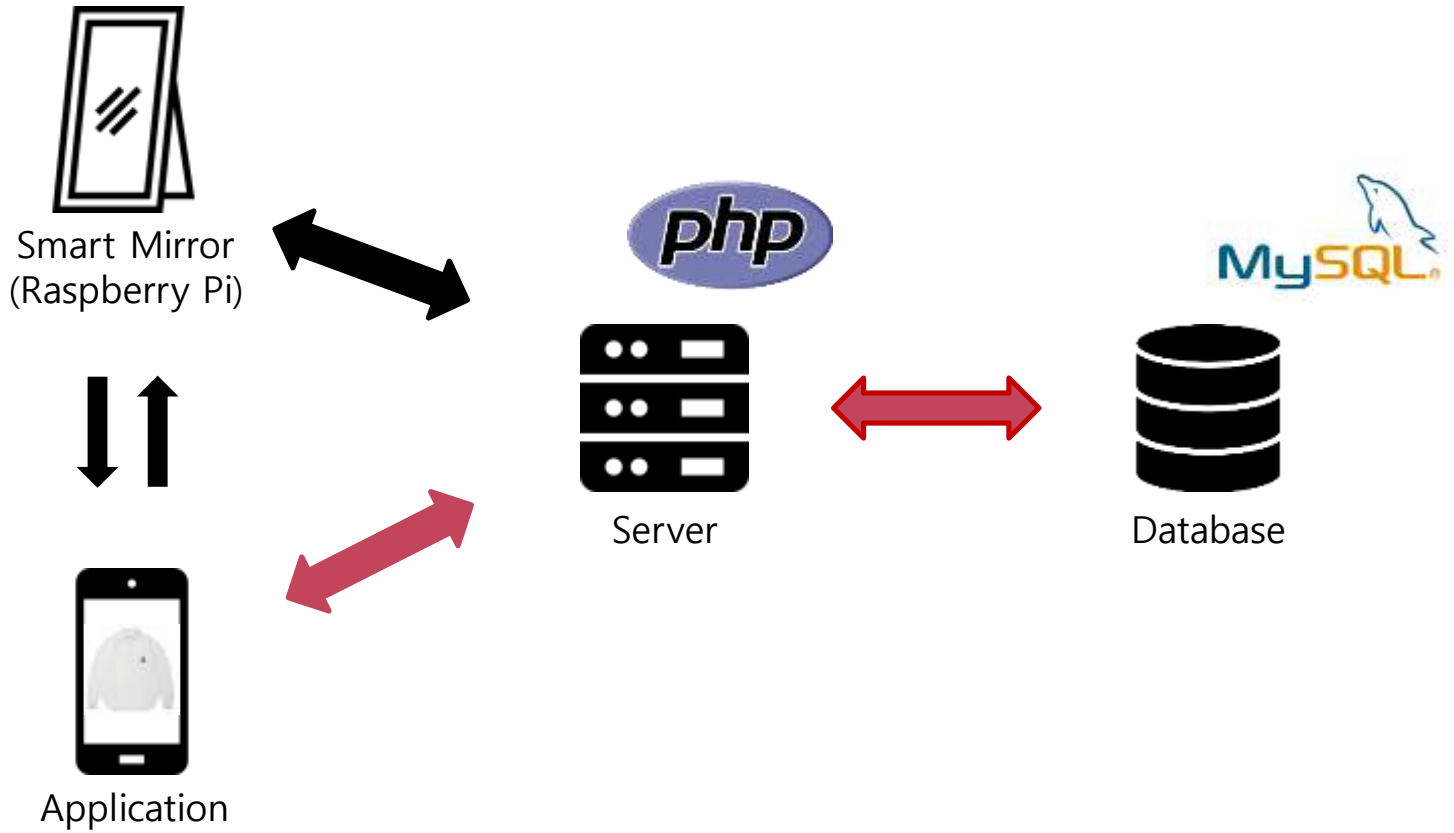
```
# make a combination to recommend styling with user's clothes
if temperature_section < 4:
    recommedation.top_bottom(top_temperature_section, bottom_temperature_section)
else:
    recommedation.outer_top_bottom(temperature_section, top_temperature_section, bottom_temperature_section)
```

```
# for top and bottom
def top_bottom(top_temperature_section,bottom_temperature_section):
    sql="SELECT  t.ID, b.ID, t.category,b.category, t.color, b.color, b.bottom_fit FROM U_top_info as t JOIN U_bottom_info as b WHERE t.temperature_
    section="+str(top_temperature_section)+" AND b.temperature_section="+str(bottom_temperature_section)+";"
    curs.execute(sql)
    result=pd.DataFrame(curs.fetchall())
    print(result)

    result_size=len(result) # 모든 경우의 수 갯수
    scores=[]
    for index,row in result.iterrows():
        topID=row[0]
        bottomID=row[1]
        topCate=row[2]
        bottomCate=row[3]
        topColor=row[4]
        bottomColor=row[5]
        bottomFit=row[6]
        score=0
        combi=[topID,bottomID]

        score=topCate_bottomCate.loc[bottomCate][topCate]+topColor_bottomColor.loc[bottomColor][topColor]+topCate_bottomFit.loc[bottomFit][topCate]
        scores.append([combi,score])
```

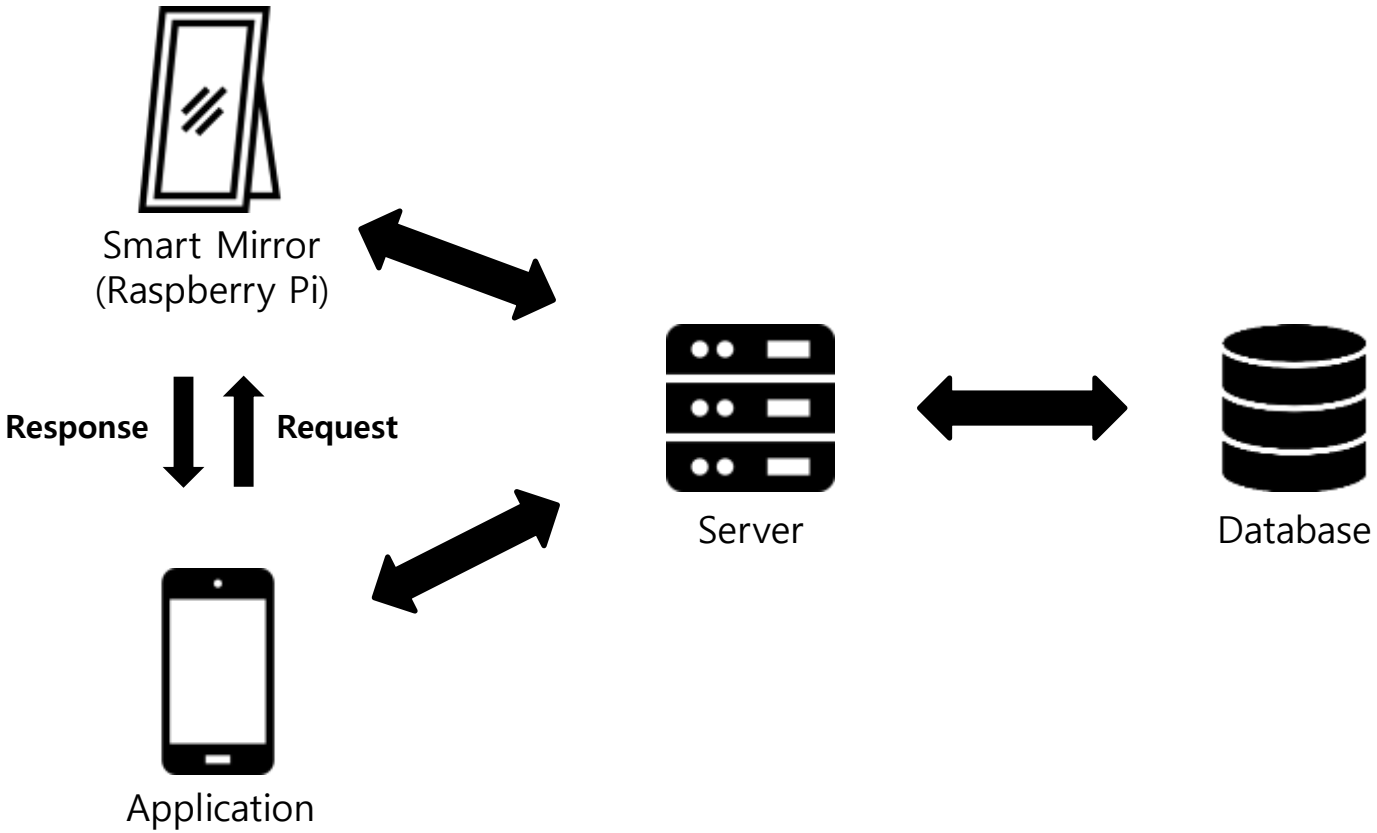
1. STYLING Button



1. STYLING Button



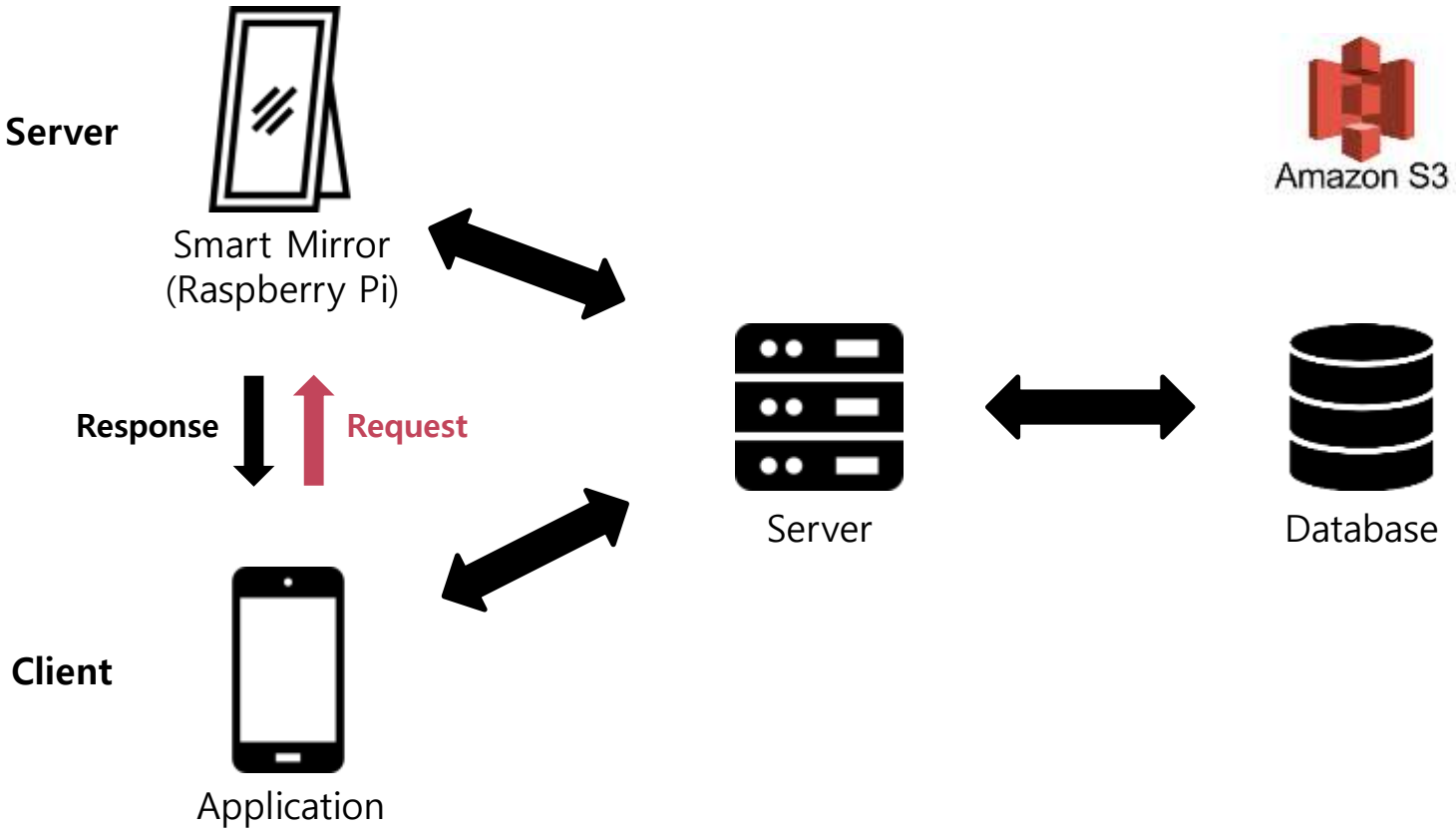
2. CAMERA Button



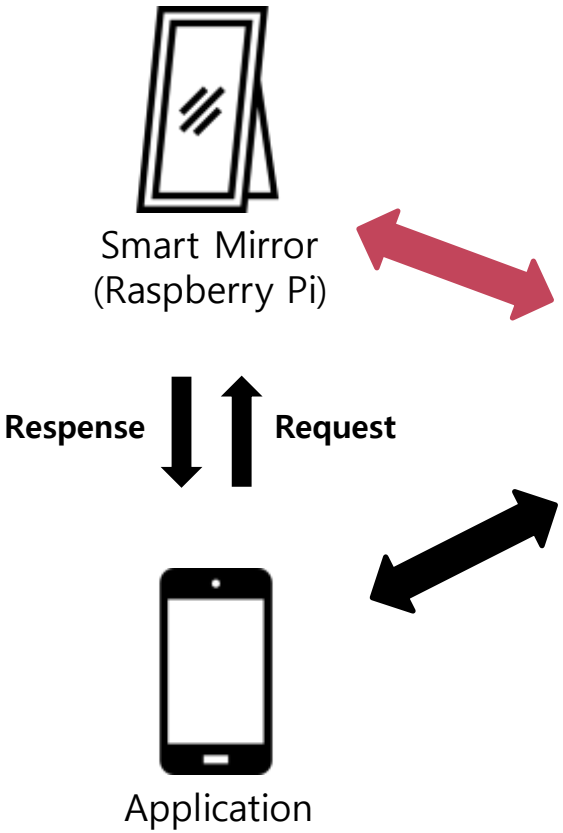
Implementation

2. CAMERA Button

이름	유형	마지막 수정
top_1.jpg	jpg	2021. 12. 13. am 11:07:44 AM KST
top_2.jpg	jpg	2021. 12. 13. am 11:07:42 AM KST
top_3.jpg	jpg	2021. 12. 13. am 11:07:43 AM KST
top_4.jpg	jpg	2021. 12. 13. am 11:07:34 AM KST
top_5.jpg	jpg	2021. 12. 13. am 11:07:44 AM KST



2. CAMERA Button



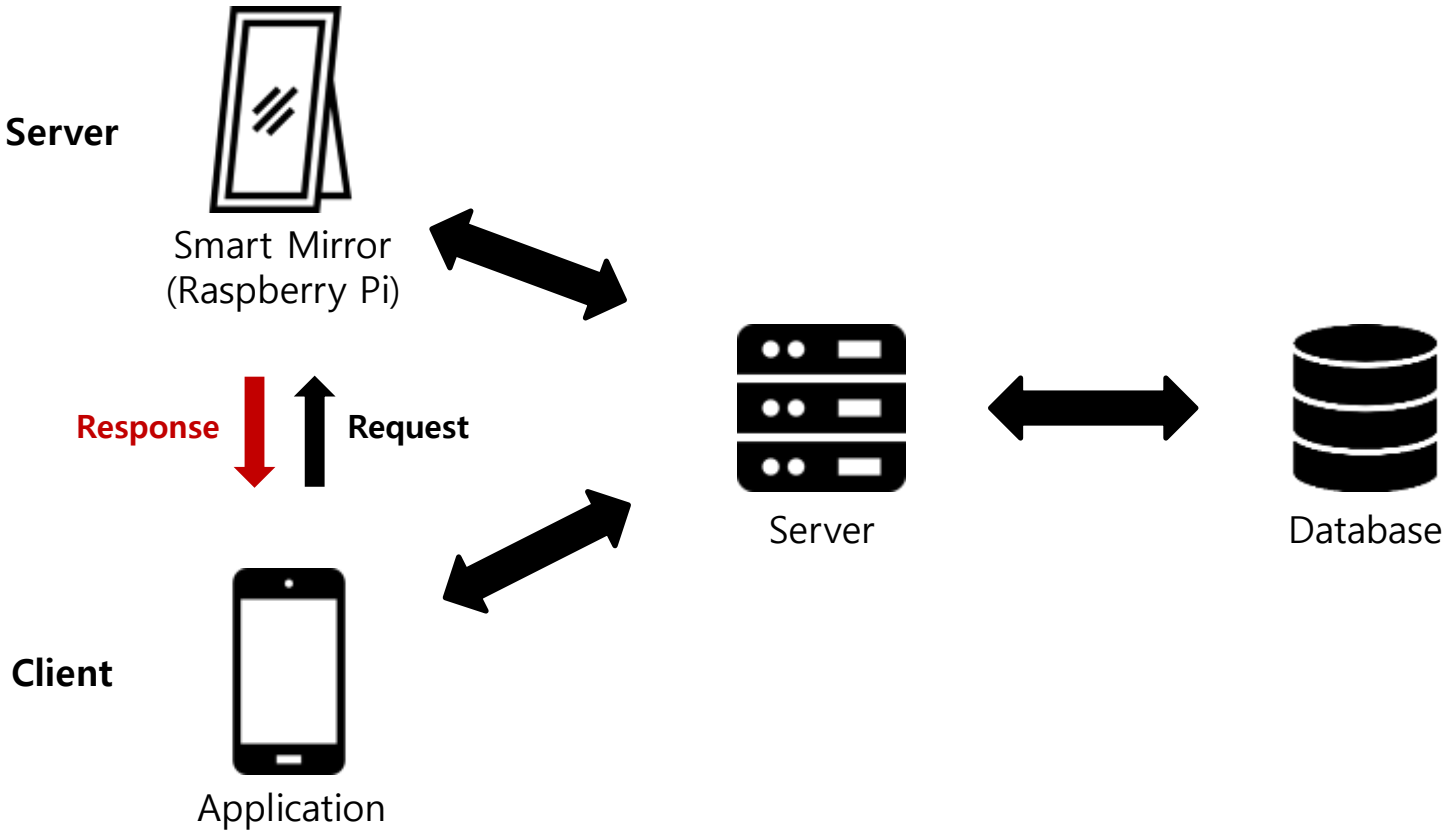
Information table

ID	category	sleevelength	color	print	temperature_section
1	맨투맨	긴팔	silver	스트라이프	3
2	맨투맨	긴팔	silver	스트라이프	3
3	민소매	민소매	white	스트라이프	1
4	민소매	민소매	silver	스트라이프	1
5	맨투맨	반팔	brown	스트라이프	3

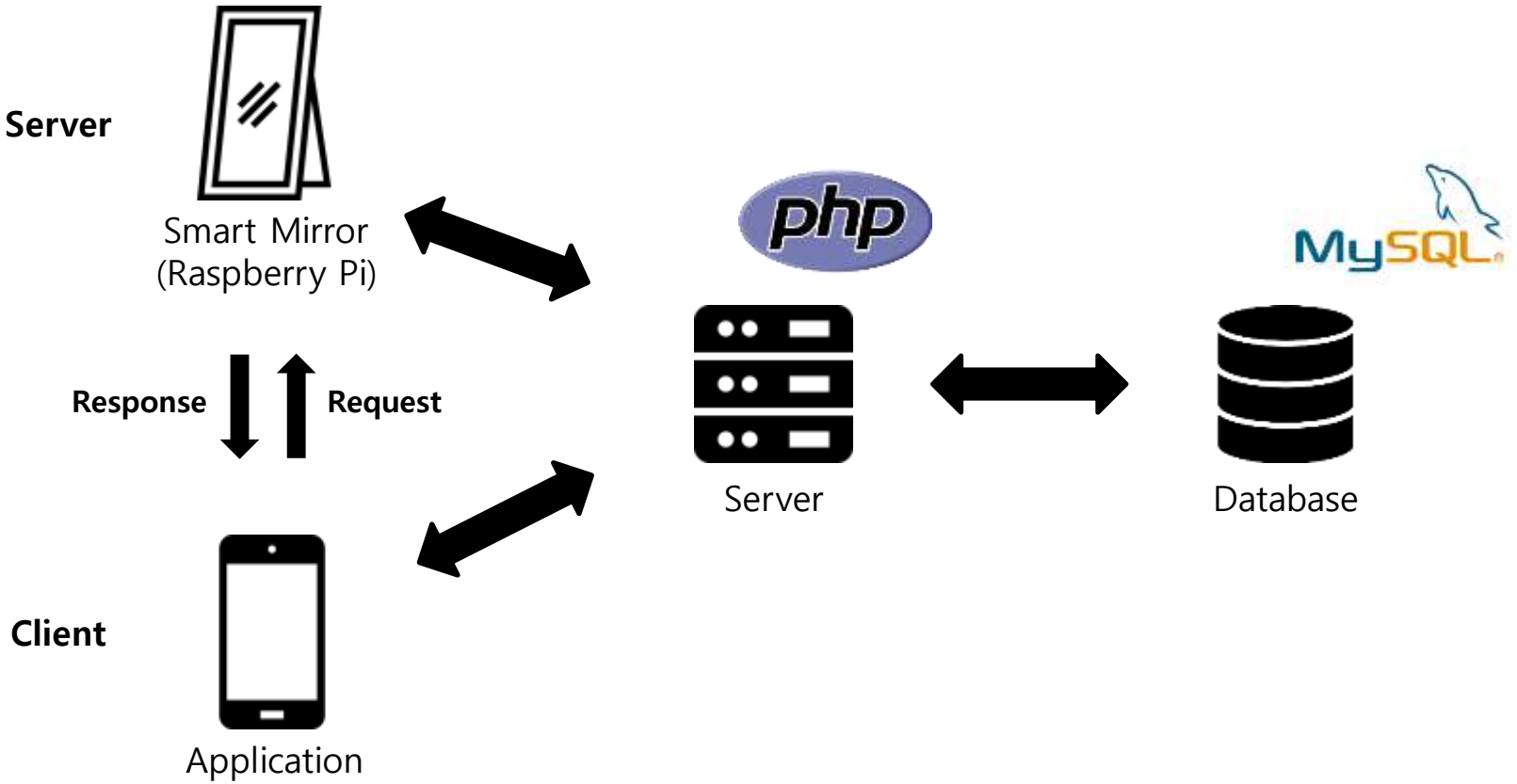
Image table

ID	image
1	https://smartmirror-bucket.s3.ap-northeast-2.a...
2	https://smartmirror-bucket.s3.ap-northeast-2.a...
3	https://smartmirror-bucket.s3.ap-northeast-2.a...
4	https://smartmirror-bucket.s3.ap-northeast-2.a...
5	https://smartmirror-bucket.s3.ap-northeast-2.a...

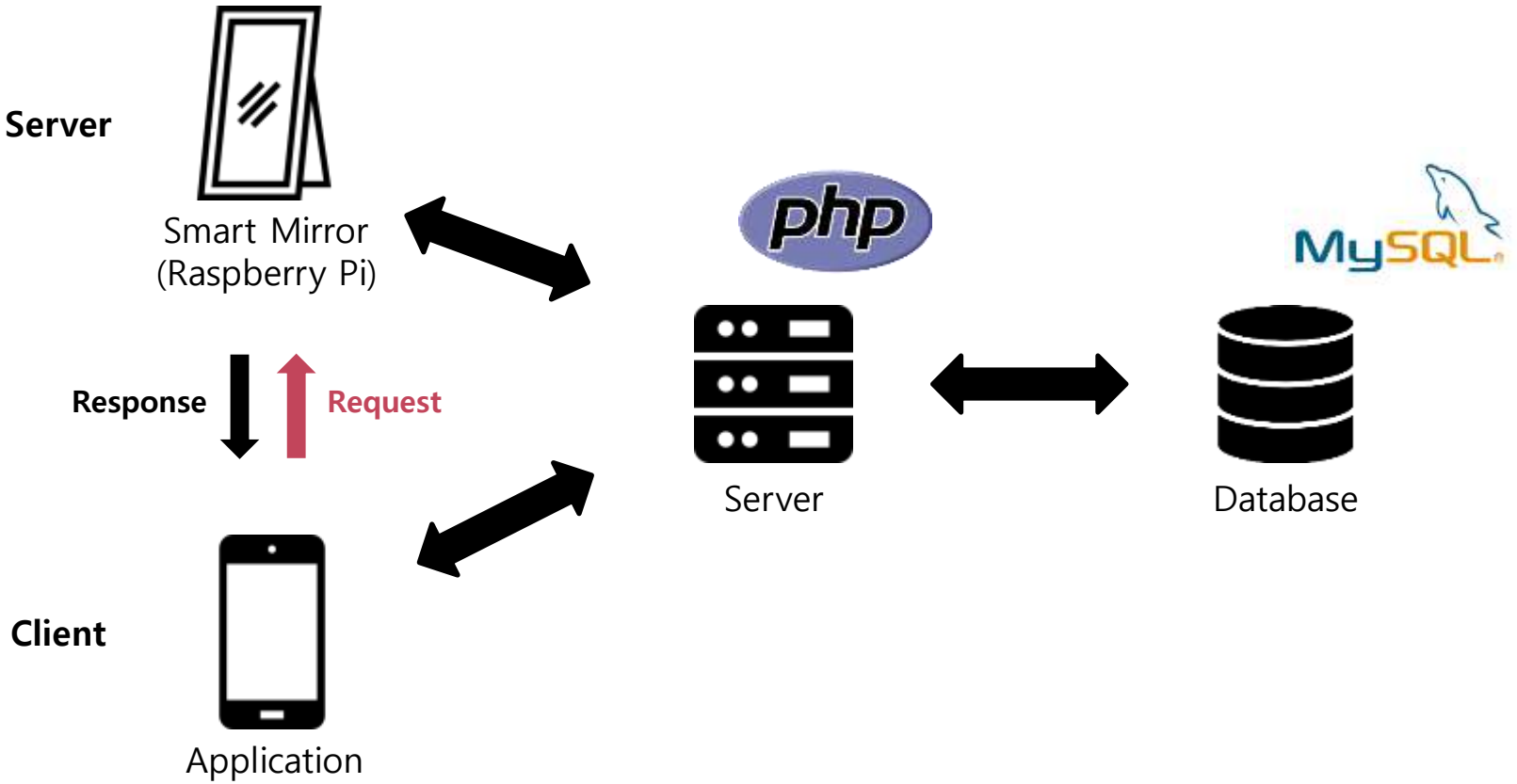
2. CAMERA Button



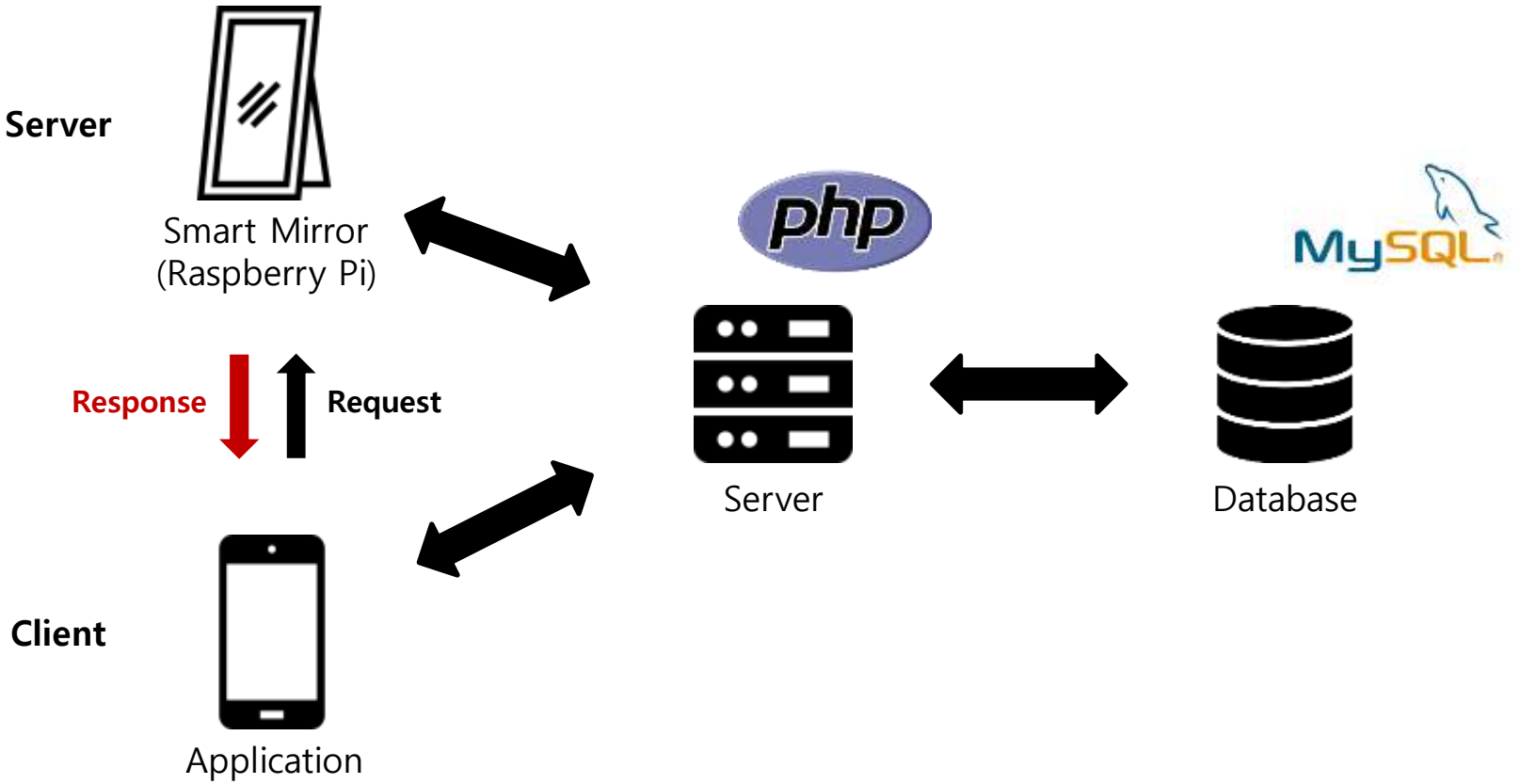
3. CLOSET Button



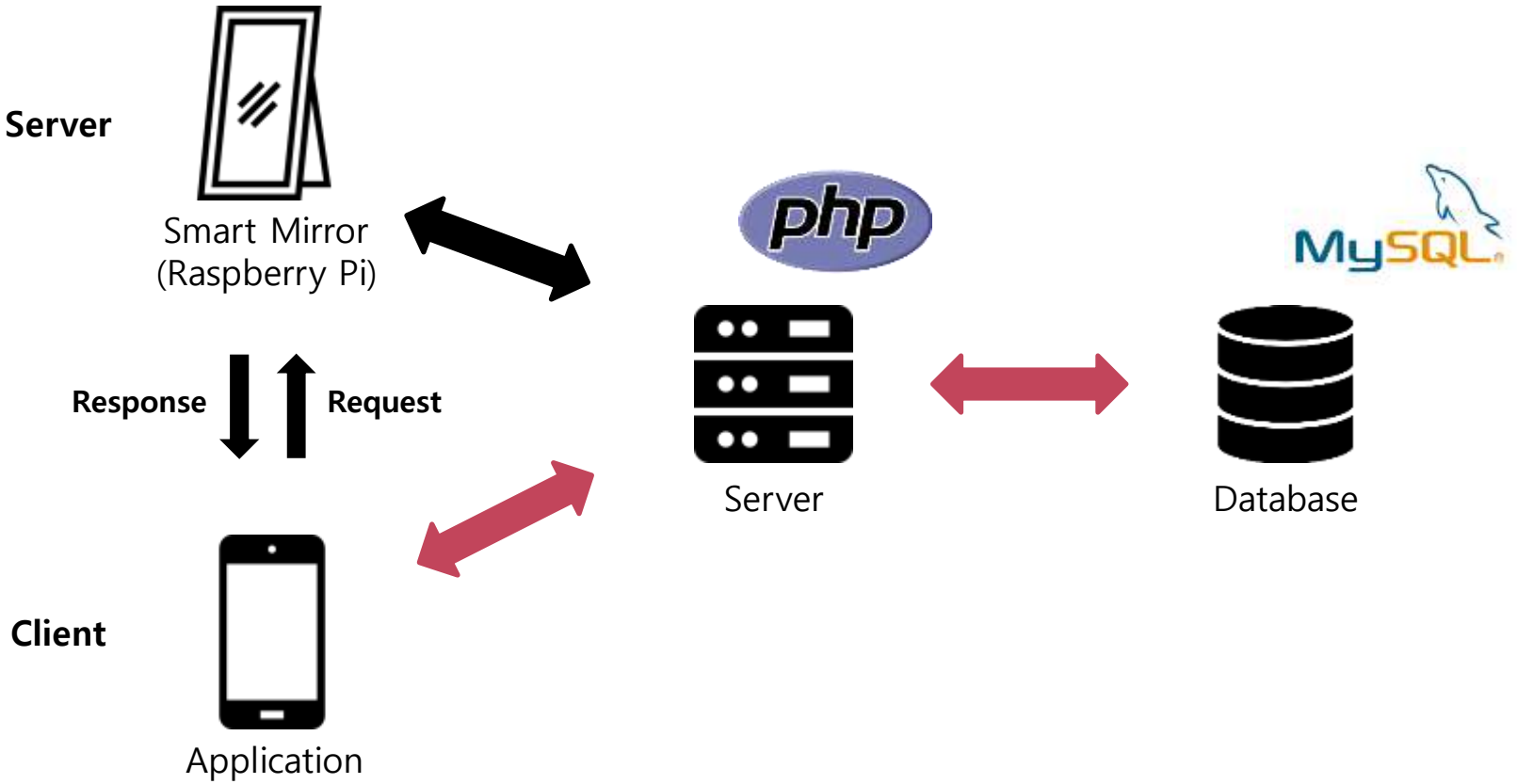
3. CLOSET Button



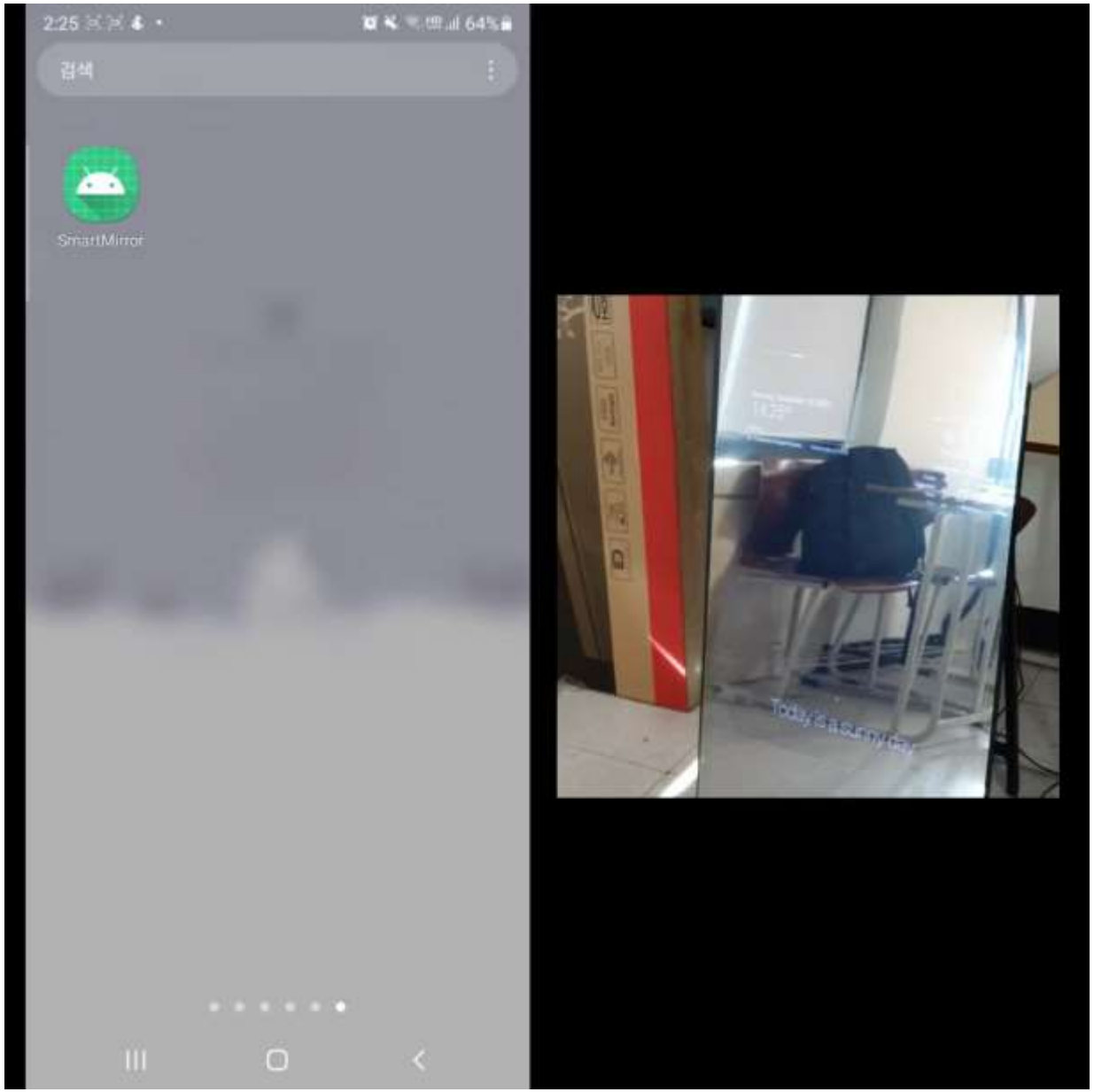
3. CLOSET Button



3. CLOSET Button



Project Demo



Future Plan

DECEMBER

- Modified application and add voice recognition

JANUARY

- Testing

FEBRUARY

- Wiki page & Documentation

Role

Choi Hyeongin

- OpenCV
- RasberryPi

Lee Minseo

Database
Appication

Lee Sojeong

UI
Crawling

Thank you

Github:

https://github.com/minseo300/GraduationProject