



PetPlant Project

Konkuk University CSE 2018



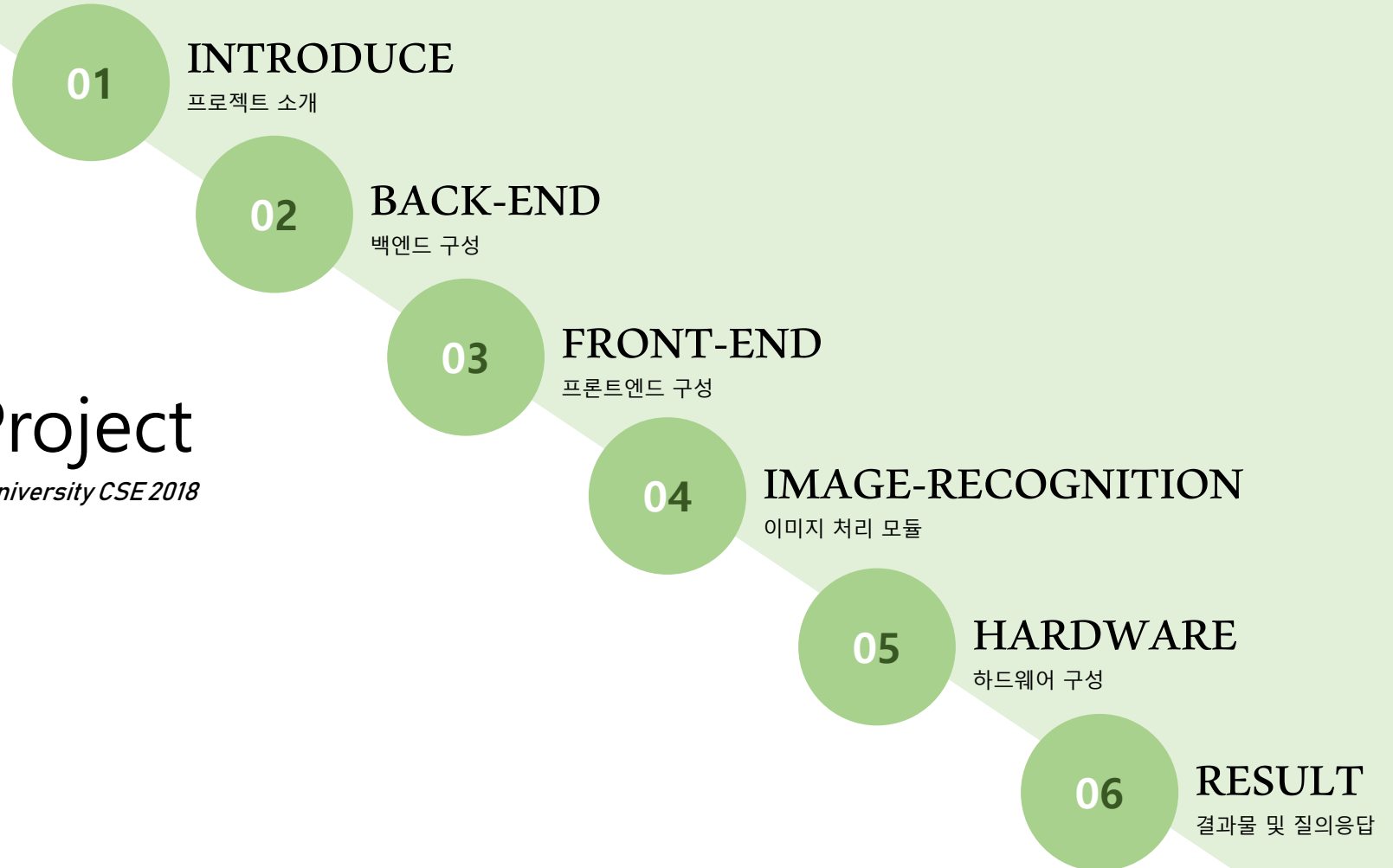
201311315 김상원 201311267 김수영 201311297 이상명 201311315 조희권
담당교수: 김기천 교수님



PET PLANT

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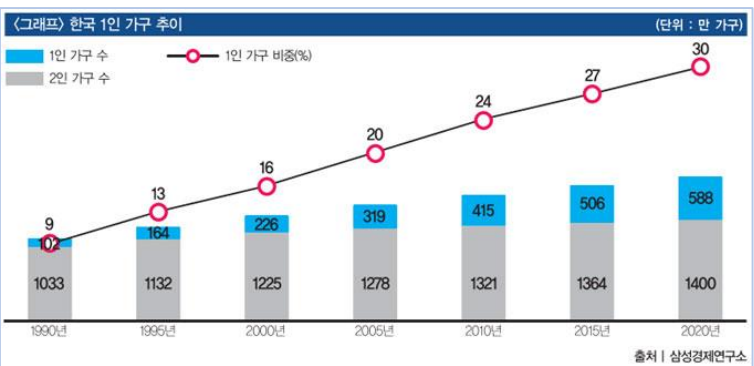
INTRODUCE 프로젝트 개요

국내 애완식물 반려식물 수요 증가

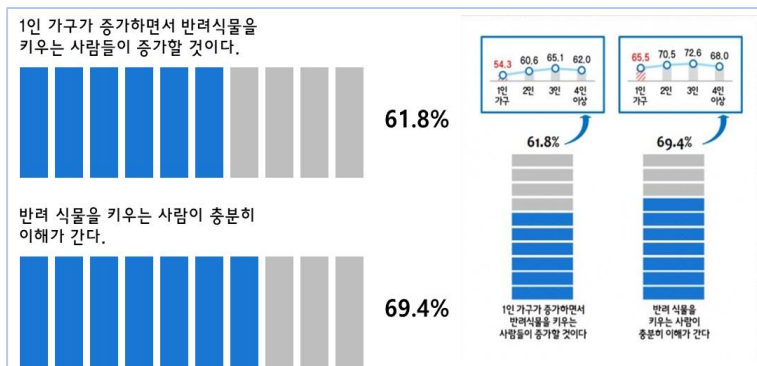
식물 키움에 대한 어려움 존재

- 습도, 온도에 따른 물 조절
- 식물의 정보 및 노하우 부족

반려식물 도우미의 필요성 증가



삼성경제연구소 1인 가구 추이 그래프



트렌드 모니터 조사 결과



INTRODUCE 프로젝트 목표



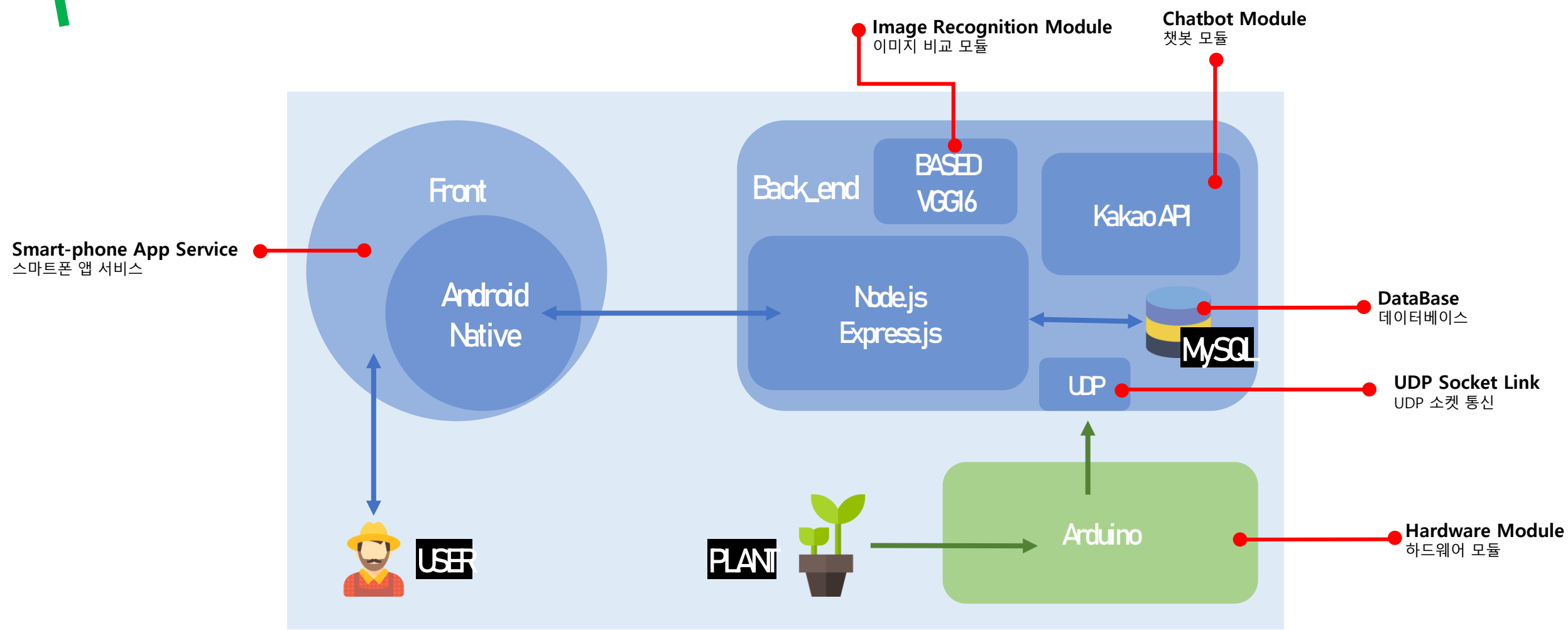
반려식물 실시간 모니터링 기능

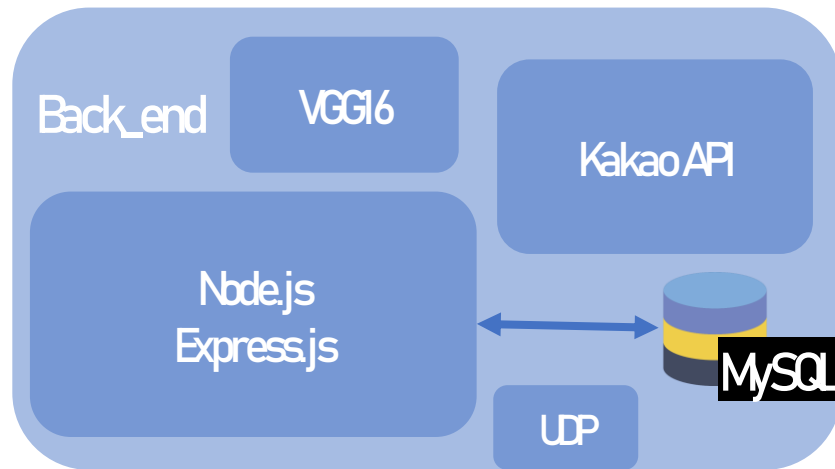
식물 양육에 대한 다양한 정보 제공

- 화분상태
- 화분과의 교감
- 최적환경 제안



INTRODUCE 시스템 구성도





BACK-END Internal System Structure

- Windows Server : Windows 10 Education
- Express.js & Node.js
- Image Recognition Module
- Chatbot Module

Express.js

Back-End Server

- 데이터베이스 생성 & 수정 & 삭제
- 프론트 API 제공
- 아두이노 정보 수신

Kakao-API

Chatbot Module

- 카카오톡 챗봇 서비스
- 실시간 식물정보 확인 기능
- 식물과의 정서적 교감

Node.js

Back-End Module Manager

- 백엔드 모듈 제어
- 데이터 흐름 조율
- 이벤트 처리 I/O 프레임워크

Keras

Neural Network Library

- 오픈소스 신경망 라이브러리
- 텐서플로 내부 동작
- 신경망 기반 기계학습 구현

My-SQL

DataBase

- 데이터베이스 구성
- 식물 정보 & 환경 정보
- 사용자 정보 관리

Learning Model

Image Recognition Module

- 식물 이미지 인식 모듈 및 모델
- VGG16 모델 기반
- 자체 모델 제작

BACK-END 백엔드 구성

2939...	5396.176389	211.36.157.227	117.16.136.73	66	UDP	34855 → 8080 Len=24
2942...	5404.176101	211.36.157.227	117.16.136.73	66	UDP	34855 → 8080 Len=24
2946...	5412.196502	211.36.157.227	117.16.136.73	66	UDP	34855 → 8080 Len=24
2949...	5420.177141	211.36.157.227	117.16.136.73	66	UDP	34855 → 8080 Len=24
2952...	5428.138520	211.36.157.227	117.16.136.73	66	UDP	34855 → 8080 Len=24

0000	50 b7 c3 a2 3e 1f 2c 23 3a 00 ca aa 08 00 45 00	P...>.,# :.....E.
0010	00 34 00 0a 00 00 ef 11 5d 4d d3 24 9d e3 75 10	.4.....]M.\$..u.
0020	88 49 88 27 1f 90 00 20 48 15 4b 43 47 32 30 31	.I.'... H-KCG201
0030	33 30 30 30 31 3a 3a 37 31 31 3a 3a 38 31 3a 3a	30001::7 11::81::
0040	32 30	20

PROCESS CONNECTION

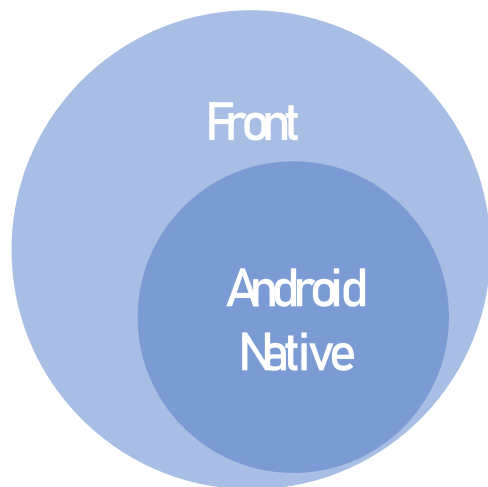
Arduino Network Communication

- Using UDP (User Datagram Protocol) packet
- SID :: MoistureData :: Illuminance :: Temperature
- SID : Unique of Arduino
- Using 8080 port

App Network Communication

- Using TCP (Transmission Control Protocol)
- App & Server connection
- Using 8080 port

```
var server = app.listen(8080, function () {
  var host = server.address().address
  var port = server.address().port
  console.log("Express app listening at http://%s:%s", host, port)
})
```

FRONT-END External System Structure

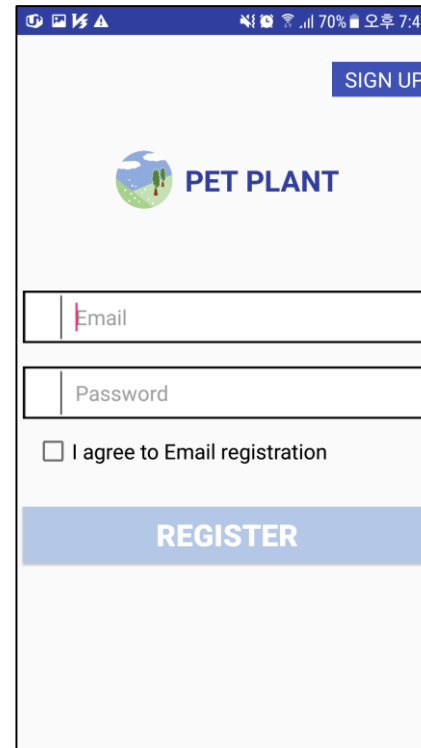
- Service on Android System
- Android Native Develop
- Communication with Server by TCP Protocol



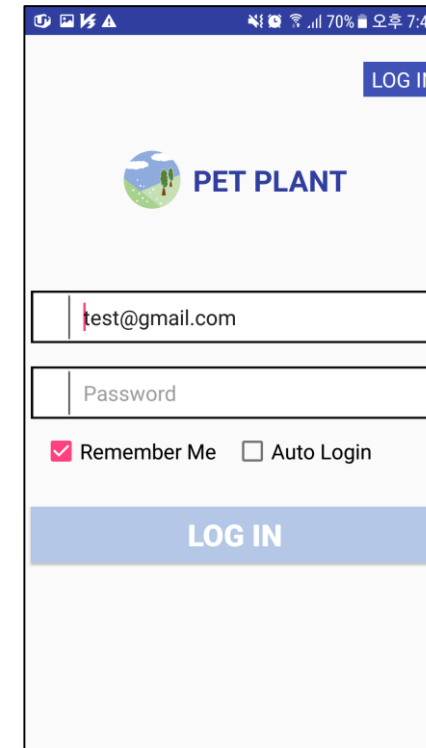
FRONT-END 프론트엔드 이미지



Stand By View



Sign Up View

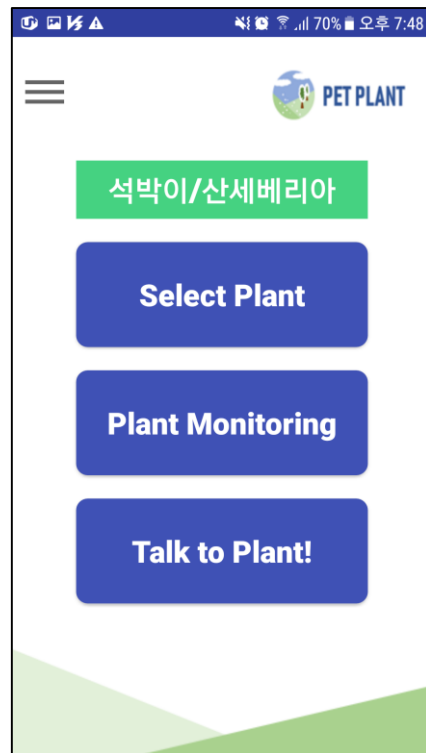


Log In View

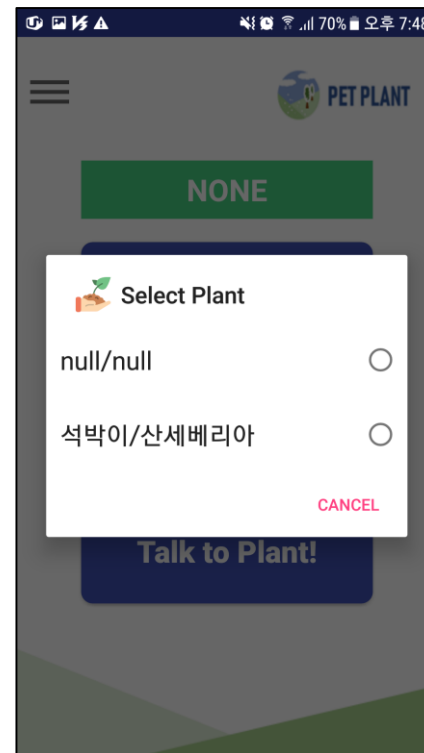




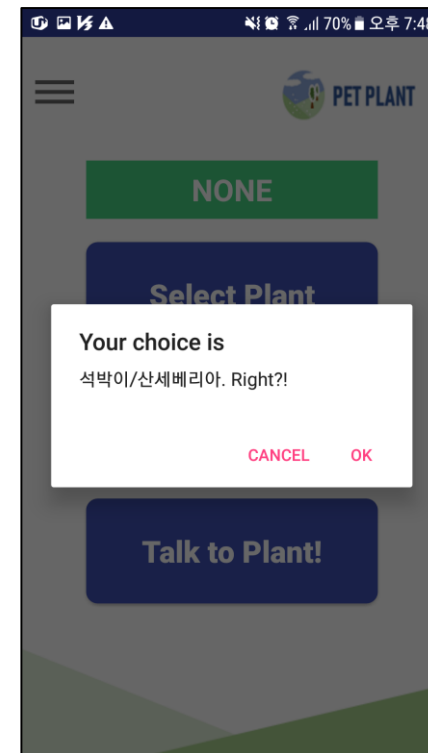
FRONT-END 프론트엔드 이미지



Main View



Select Plant View

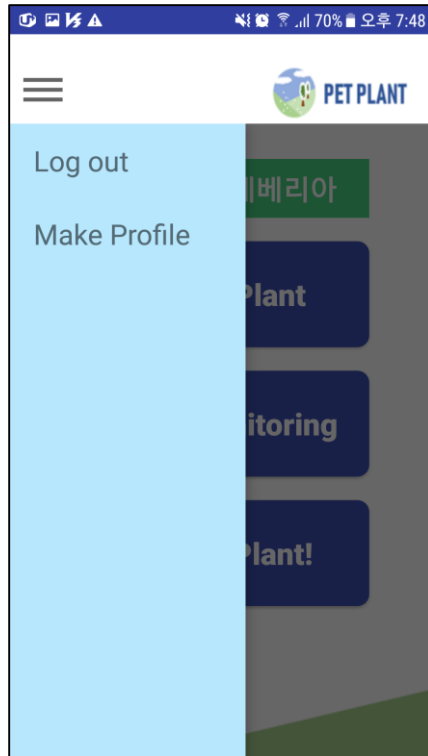


Plant Monitoring View

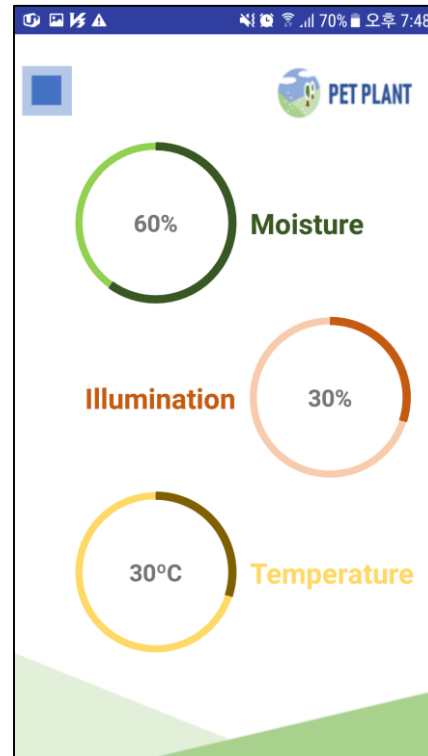




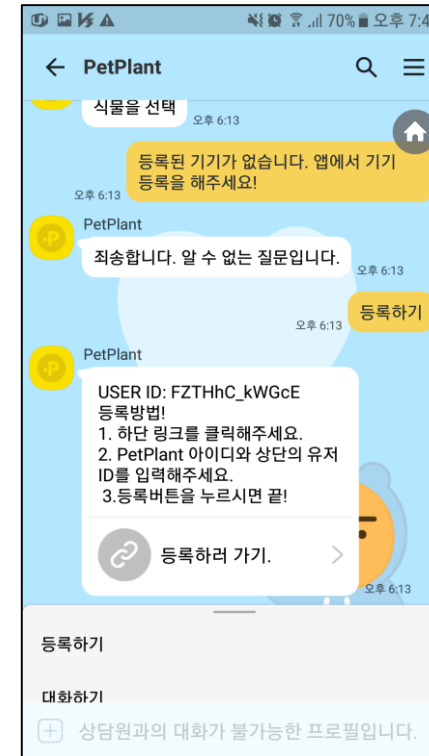
FRONT-END 프론트엔드 이미지



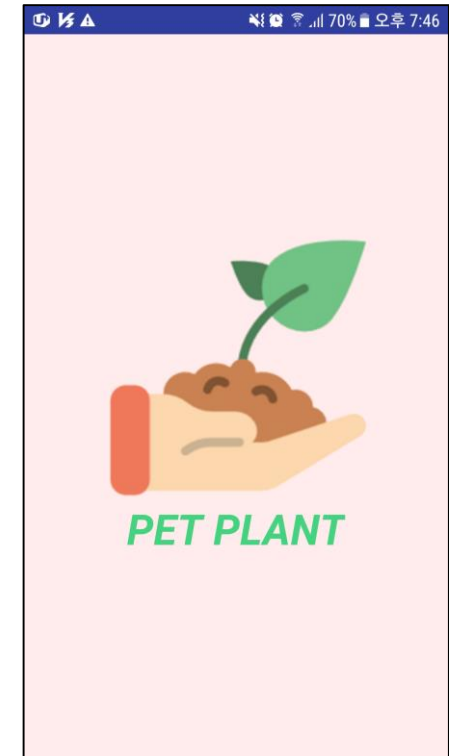
Menu Bar View



Plant Information View



Kakao Chatting View



Loading View



IMAGE MODULE Based Machine Learning

- 기계학습 기반 이미지 인식 모듈
- 자체제작 학습모델 구현
- 식물 사진을 통한 해당 종 파악

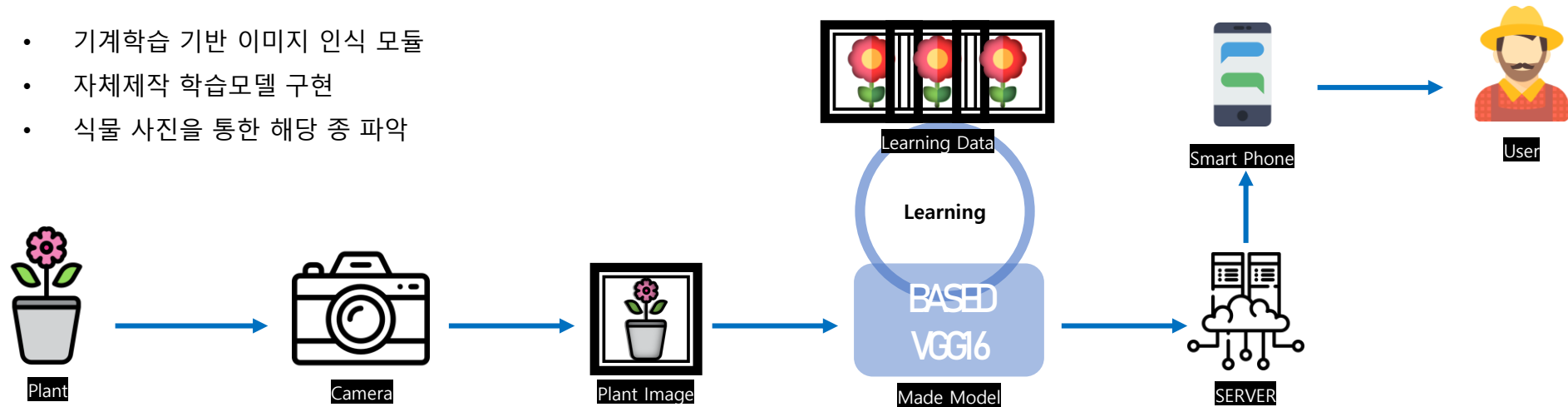


IMAGE-RECOGNITION 이미지 처리 모델

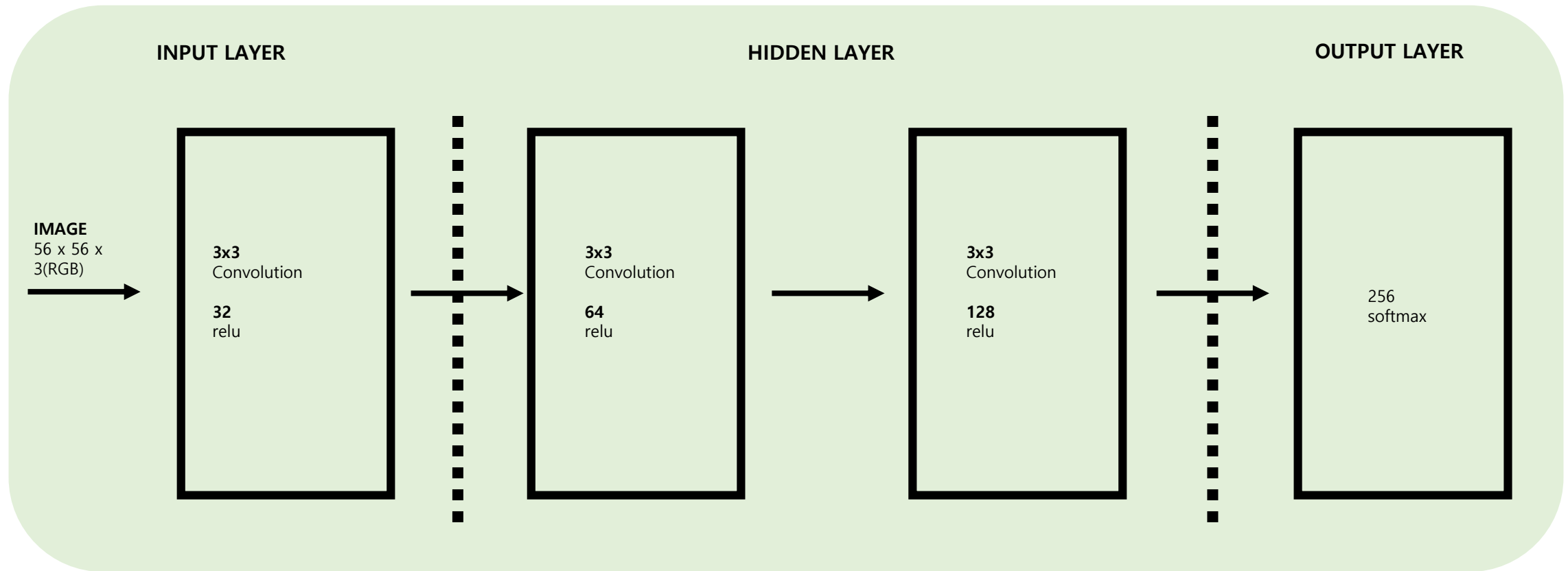




IMAGE-RECOGNITION 이미지 처리 모듈

```
(image) C:\Project\my-pet-plant\image_classification_module>python prediction.py
Using TensorFlow backend.
Found 348 images belonging to 2 classes.
Found 11 images belonging to 2 classes.
Epoch 1/50
2018-10-29 23:48:15.266576: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:1405] Found device 0 with properties:
name: GeForce GTX 1060 6GB major: 6 minor: 1 memoryClockRate(GHz): 1.835
pciBusID: 0000:01:00.0
totalMemory: 6.00GiB freeMemory: 4.966iB
2018-10-29 23:48:15.270584: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:1484] Adding visible gpu devices: 0
C:\Users\lllls\Anaconda3\envs\image\lib\site-packages\PIL\tiffimageplugin.py:747: UserWarning: Possibly corrupt EXIF data. Expecting to read 846
" Skipping tag %s" % (size, len(data), tag))
C:\Users\lllls\Anaconda3\envs\image\lib\site-packages\PIL\tiffimageplugin.py:747: UserWarning: Possibly corrupt EXIF data. Expecting to read 125
" Skipping tag %s" % (size, len(data), tag))
C:\Users\lllls\Anaconda3\envs\image\lib\site-packages\PIL\tiffimageplugin.py:747: UserWarning: Possibly corrupt EXIF data. Expecting to read 8 b
" Skipping tag %s" % (size, len(data), tag))
2018-10-29 23:48:17.581755: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:965] Device interconnect StreamExecutor w
2018-10-29 23:48:17.586341: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:971] 0
2018-10-29 23:48:17.588598: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:984] 0: N
2018-10-29 23:48:17.593195: I T:\src\github\tensorflow\tensorflow\core\common_runtime\gpu\gpu_device.cc:1097] Created TensorFlow device (/job:loc
(device: 0, name: GeForce GTX 1060 6GB, pci bus id: 0000:01:00.0, compute capability: 6.1)
15/15 [=====] - 7s 467ms/step - loss: 0.5306 - acc: 0.7738 - val_loss: 1.1201 - val_acc: 0.5455
Epoch 2/50
15/15 [=====] - 4s 238ms/step - loss: 0.5359 - acc: 0.7601 - val_loss: 0.5740 - val_acc: 0.5455
Epoch 3/50
15/15 [=====] - 4s 285ms/step - loss: 0.4692 - acc: 0.8241 - val_loss: 0.7356 - val_acc: 0.5455
Epoch 4/50
15/15 [=====] - 4s 236ms/step - loss: 0.4196 - acc: 0.8303 - val_loss: 0.3083 - val_acc: 1.0000
Epoch 5/50
15/15 [=====] - 4s 234ms/step - loss: 0.3668 - acc: 0.8497 - val_loss: 0.3032 - val_acc: 0.9091
```

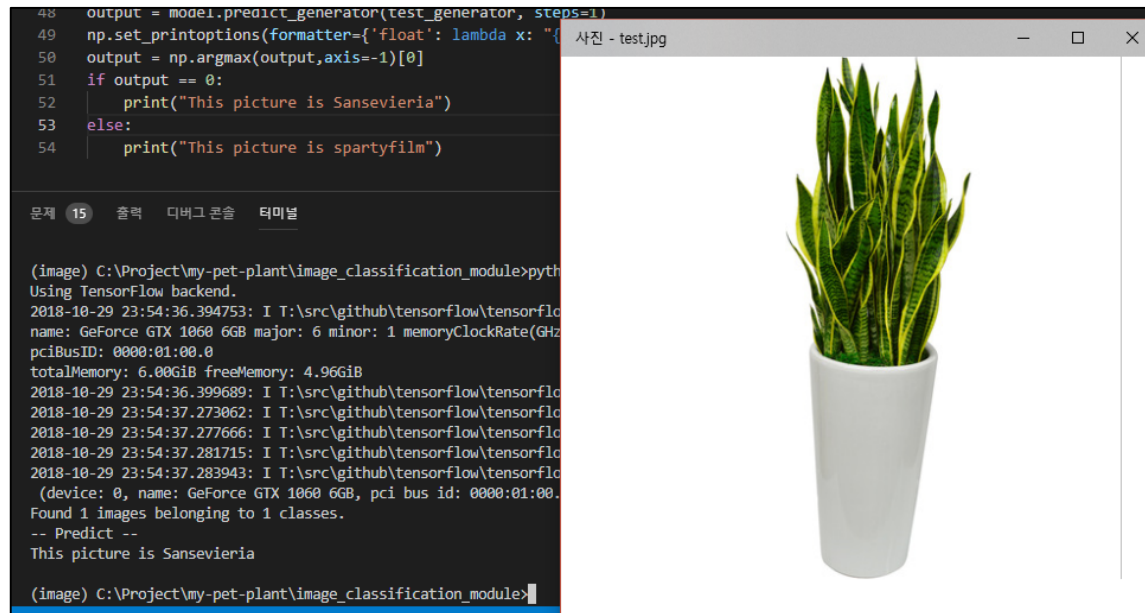
실행결과 01

```
Epoch 40/50
15/15 [=====] - 4s 234ms/step - loss: 0.1093 - acc: 0.9598 - val_loss: 0.0984 - val_acc: 0.9091
Epoch 41/50
15/15 [=====] - 4s 241ms/step - loss: 0.0938 - acc: 0.9598 - val_loss: 0.1043 - val_acc: 0.9091
Epoch 42/50
15/15 [=====] - 4s 258ms/step - loss: 0.0887 - acc: 0.9700 - val_loss: 0.0975 - val_acc: 0.9091
Epoch 43/50
15/15 [=====] - 4s 254ms/step - loss: 0.0752 - acc: 0.9703 - val_loss: 0.0857 - val_acc: 1.0000
Epoch 44/50
15/15 [=====] - 4s 235ms/step - loss: 0.0783 - acc: 0.9622 - val_loss: 0.0978 - val_acc: 0.9091
Epoch 45/50
15/15 [=====] - 4s 243ms/step - loss: 0.0819 - acc: 0.9708 - val_loss: 0.0939 - val_acc: 0.9091
Epoch 46/50
15/15 [=====] - 4s 246ms/step - loss: 0.0829 - acc: 0.9664 - val_loss: 0.0989 - val_acc: 0.9091
Epoch 47/50
15/15 [=====] - 4s 236ms/step - loss: 0.0741 - acc: 0.9729 - val_loss: 0.1037 - val_acc: 0.9091
Epoch 48/50
15/15 [=====] - 3s 226ms/step - loss: 0.0985 - acc: 0.9541 - val_loss: 0.0945 - val_acc: 0.9091
Epoch 49/50
15/15 [=====] - 4s 247ms/step - loss: 0.0812 - acc: 0.9664 - val_loss: 0.0961 - val_acc: 0.9091
Epoch 50/50
15/15 [=====] - 4s 243ms/step - loss: 0.0610 - acc: 0.9833 - val_loss: 0.0943 - val_acc: 0.9091
-- Evaluate --
acc: 90.91%
-- Predict --
{'sansevieria': 0, 'spartyfilm': 1}
[[0.216 0.784]
[0.003 0.997]
[0.995 0.005]
[1.000 0.000]
[0.006 0.994]
[0.966 0.034]]
```

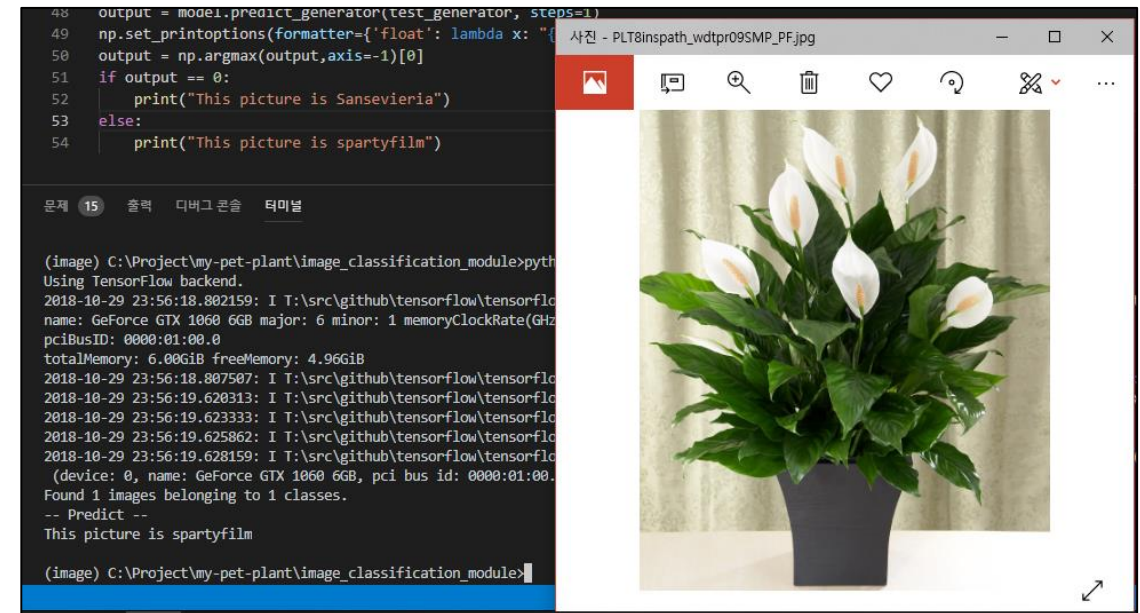
실행결과 02



IMAGE-RECOGNITION 실행예시



Example 01



Example 02

Arduino

HARDWARE Physical System Module

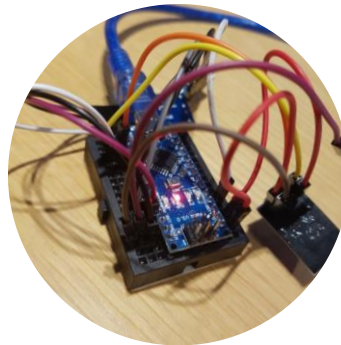
- Arduino NANO Board
- ESP8266-01
- MH-Sensor Module Flying Fish
- SEN-0114

화분에서의 센서 모듈 구성

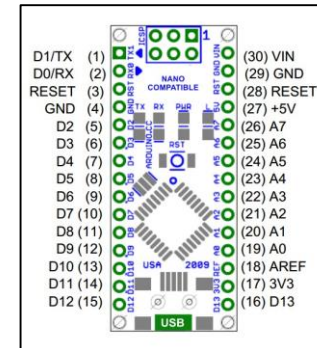
화분에 최적합한 크기와 활용도 필요

- 하드웨어 모듈의 크기
- 센서 모듈 기능
- Utility

Arduino NANO Board 최적합 모듈로 선정



Arduino NANO Board

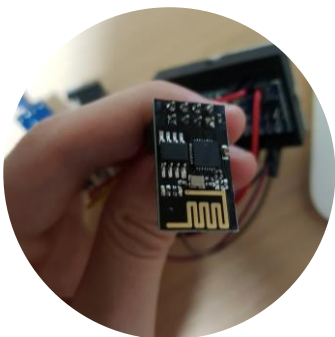


Arduino NANO Board Structure

ESP8266-01

WIFI Module

- 와이파이 모듈
- 아두이노와 인터넷 상호연결
- 서버와의 통신 구성



ESP8266-01

MH-FLYING-FISH

Illuminance Sensor Module

- 조도 센서 모듈
- 빛의 세기 측정
- 빛의 세기에 따른 조도 수치 변화

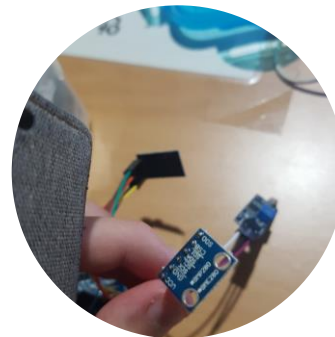


MH-SENSOR-FLYING-FISH

BMP280

Temperature Sensor Module

- 온도 센서 모듈
- 실시간 온도 변화 측정
- 온도 측정 후 보드로 데이터 전송

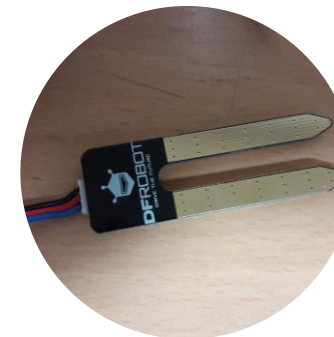


BMP280

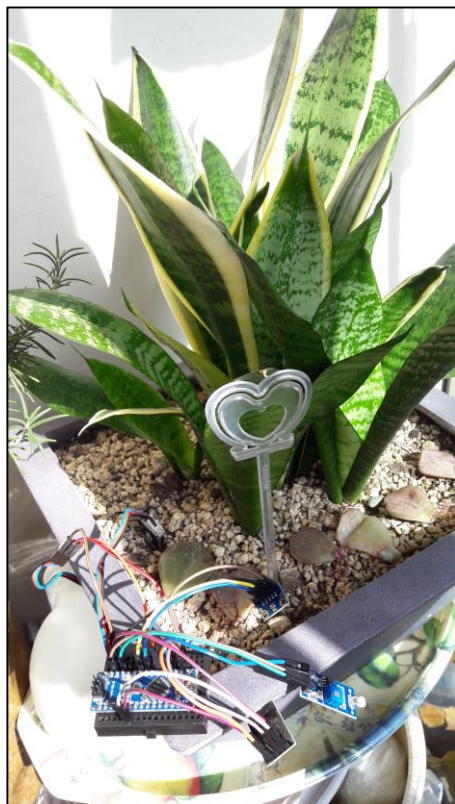
SEN-0114

Moisture Sensor Module

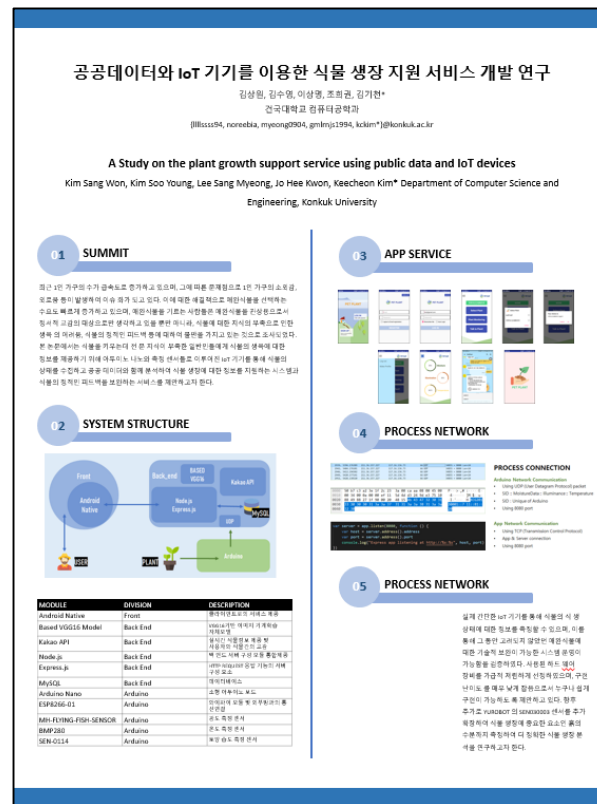
- 습도 센서 모듈
- 흙 내부 습도 변화 측정
- 전해질 차를 통한 습도 측정



SEN-0114



System Example



Conference Poster

Conference

2018.11.05

- 건국대학교 소프트웨어융합학부 졸업작품전시회
- 실제 화분을 통한 센서 동작 모의 시연
- 스마트폰을 통한 서비스 제공 시연
- 사진을 통한 이미지 분석 시연

- 식물양육을 위한 공공데이터 사용
- IoT 기술을 사용하여 각 모듈간의 통신 구현
- 센서 및 마이크로 프로세서 등 하드웨어적 기술 응용

