

Mr. Changwoo Lee / Robogates Co., Ltd

Robotics Case Study

On Smart Farm System

3.~5. Sep. 2019.

Content

- ▶ 0. Speaker & Company
- ▶ 1. Introduction to Farm Automation
- ▶ 2. Robotics Case Study On Hydroponics
- ▶ 3. Robotics Case Study On Harvesting
- ▶ 4. K-farm Robotics model



ROBOGATES

The Gateway From Future

Gateway to New Culture - 미래로 부터 배우고, 새로움(기술,문화)의 전도자가 되

- 자연(지구,우주)으로부터 배우자.

.happy - 희망과 건강을 실천하고, 행복을 퍼트리는 회사.

(주) 로보게이

www.robogates.co

환경과 사람 - 자연에서 배우는 기술, 환경보호를 통한 사람들의 미래 희망, 건강 그리고 행복한 삶.



01 ROBOT



SIEMENS TMX S/W & DOBOT,
The best ROI solution
ROBOT simulation
& Enterprise system integration

DoBot Magician

Next Robot Arm, DOBOT M1 can give you
the easiest way to build factory automation.



WELCOME THE NEXT ROBOTIC ARM



- Repeatability 0.02mm
- Reach 400mm
- Speed 200°/s
- Payload 1.5kg

FEATURES



EASILY APPLIED TO



Workshop

Production

Stores

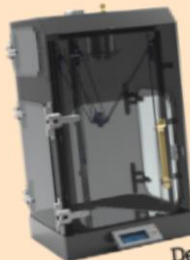
Education

02 3D 프린터

■ Rapid prototyping & 3D design



■ Low cost 3D printer solutions



Delta Pro 300L



Delta Mini 180

- Magnetic joint 방식 채택에 의한, Extruder Kit 유지보수성 개선
- Laser 조각기로 변신 기능 부가
- 한층 강력해진 Auto Leveling 기능
- Extruder 작업간 LED 조명 사용
- Filament 사용성 개선
- PLA외 ABS 출력에 최적화됨, 자체개발 ABS Warp free film 채택
- 열에 강하고 튼튼한 PC Housing
- 사용편의성 고려한 디자인
- 정면 Magnetic Door 채택
- 각 부위 Steel part로 구조강도 개선

■ 3D printing filaments production



PLA, ABS, PETG, Nylon, Carbon Fiber, Flexible, Metal

03

3D CAE / 복합소재

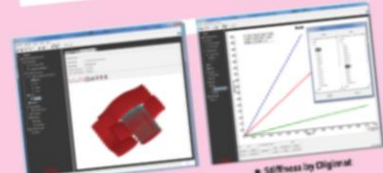
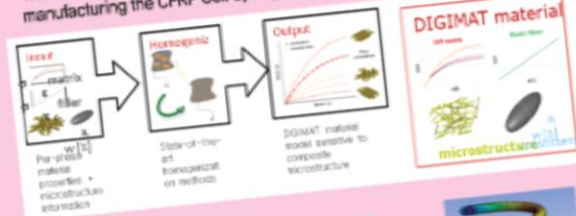
■ SIEMENS CAE S/W & Composite R&D

SIEMENS
Ingenuity for life



CFRP Coil Spring R&D Case

The development team made extraordinary strides in designing and manufacturing the CFRP Coil Spring in terms of its lightweight construction



■ FEM Design | Women Fabric, Binding

■ Stress by Digital

1. By using Digital/Matrix Field Homogenization material model calculation
2. Shape parameter for equivalent performance



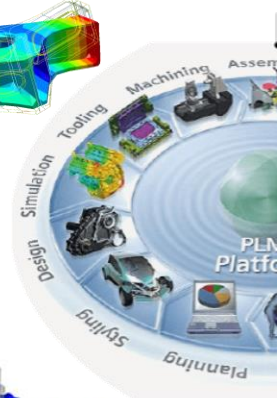
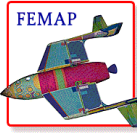
3D Simulation & Design



Business Area

Cost-Effective Collaborative 6-axis Robot Arm

▶ AI-Robotics oriented Smart Factory / Smart Farm Consulting Firm



- 3D Cax , PLM S/W
- MES/SCADA



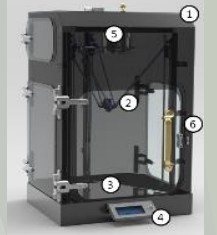
SIEMENS

3DCAE/PLM
MES 기업솔
루션

- 3DPrinter 제조/판매/교육,
- 3D융합교육, VR/AR 제작



특수 3D프린터
칼라/바이오/식품



3D로

Smart Factory
Smart Farm
ROBOT

Arm, Gripper,
Vision, AGV



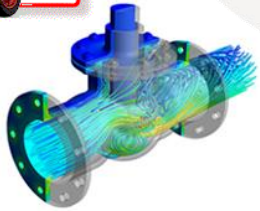
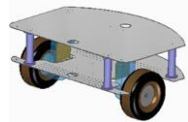
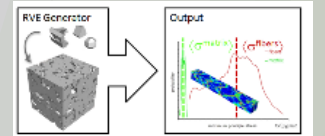
- ROBOT 판매/교육
- DOBOT magician 국내 총판
- 두산, 뉴로메타 대리점
- 스마트팩토리/스마트팜 공급기업



R&BD, Edu
연구개발/교육



- ROBOT, 3D프린터 기술
- CFRP 복합소재 경량화 부품
- 3D 프린팅 소재 개발 외



DOBOT C66-S is a lightweight collaborative 6-axis robot newly developed by DOBOT. It has successfully overcome abundant technical problems like achieving the integrated joints and servo control, and lightweight body.





- Hope / Healthy / Happy
- Gateway to New Culture
- Message from Nature

ROBOGATES Co., LTD Business Unit

전략기획실
사업 전략 / 인사/회계

SI 컨설팅 사업부
Smart Factory / Smart Farm
MES/PLM 개발구축, SI 프로젝트

AI 3D& ROBOT 기술 연구소
Robot Arm, Gripper, AGV, 3DP, 3DS, Vision, AI
R&D 과제기획/ 수행/ 특허/ 논문/ 교육

3D-Bio Medical 사업부
영상진단, 치과, ,외과, 건축
3D Cax, 3D Printing

미래 교육 사업부
로봇, SW, 3DP, 3DC
강의/ 교보재

- 스마트팩토리 SI 프로젝트
- 스마트팜 솔루션 개발

- Bio 3D프린터 개발 판매
- 산업용 3D 프린터/3D 스캐너 기술 개발
- 다관절 로봇팔 구조 및 비전인식 AI 개발
- 자동화 시스템 통신 프로그래밍
- 경량화 복합재 부품 개발

Bio ROBOT 팀
의료/인체보조/탐사로봇
Bio Sensor / Medical ROBOT/ 3DP

Smart Life 팀
복합소재, 의료용 소재
Composite Part

- 대학교육 / 직업교육 / 평생교육
- 초중고 청소년 교육





Customers



Changwoo Lee

- ▶ Now.
CEO of ROBOGATES , Disruptive Innovator,
(R&BD, New Business for Company & Univ.)
- ▶ Now. Activity, Technical Area
 - Smart Factory & Smart Farm Innovator
 - 3D CAE, Robotics, MES, PLM, 3D printer, Composites
 - Special Lecturer in many Univ.s & Company in South Korea including Hyundai, Doosan, ETRI, PPI, Shinsung, Hanyang, Ewha, Sookmyung, Sung-shin, Gun-kuk, Bucheon ...
- ▶ Before.
 - Deloitte Consulting Korea
 - KETI robotics center
 - SIEMENS Korea
- ▶ Edu.
 - Seoul National Univ. / MBA.
 - Hanyang Univ. / Mechanical Engineering.

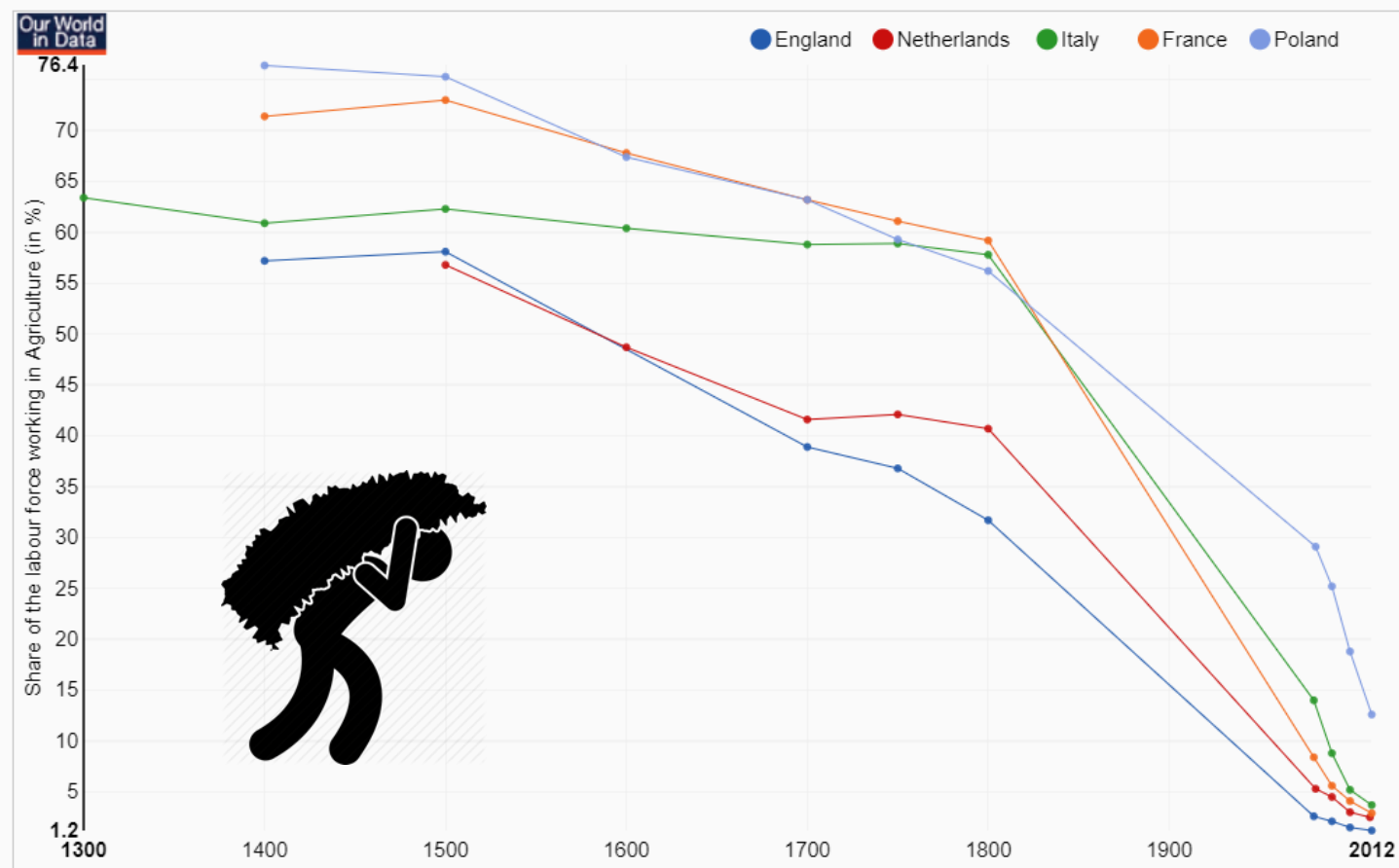




Employment in Agriculture

- Long-Run Perspective: 1300 to Today
- As countries develop, the share of the population working in agriculture is declining while more than two-thirds of the population in poor countries work in agriculture, less than 5% of the population does in rich countries.
- It is predominantly the huge productivity increase that makes this reduction in labor possible.
- Similarly, productivity gains makes it possible to reduce the agricultural land needed to feed a given number of people.

Share of the labor force working in agriculture, 1300-2012¹



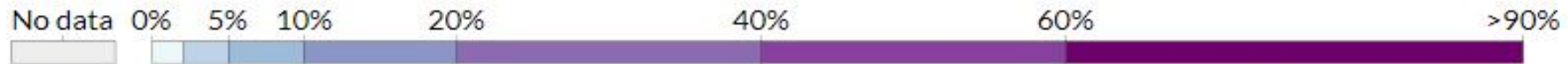
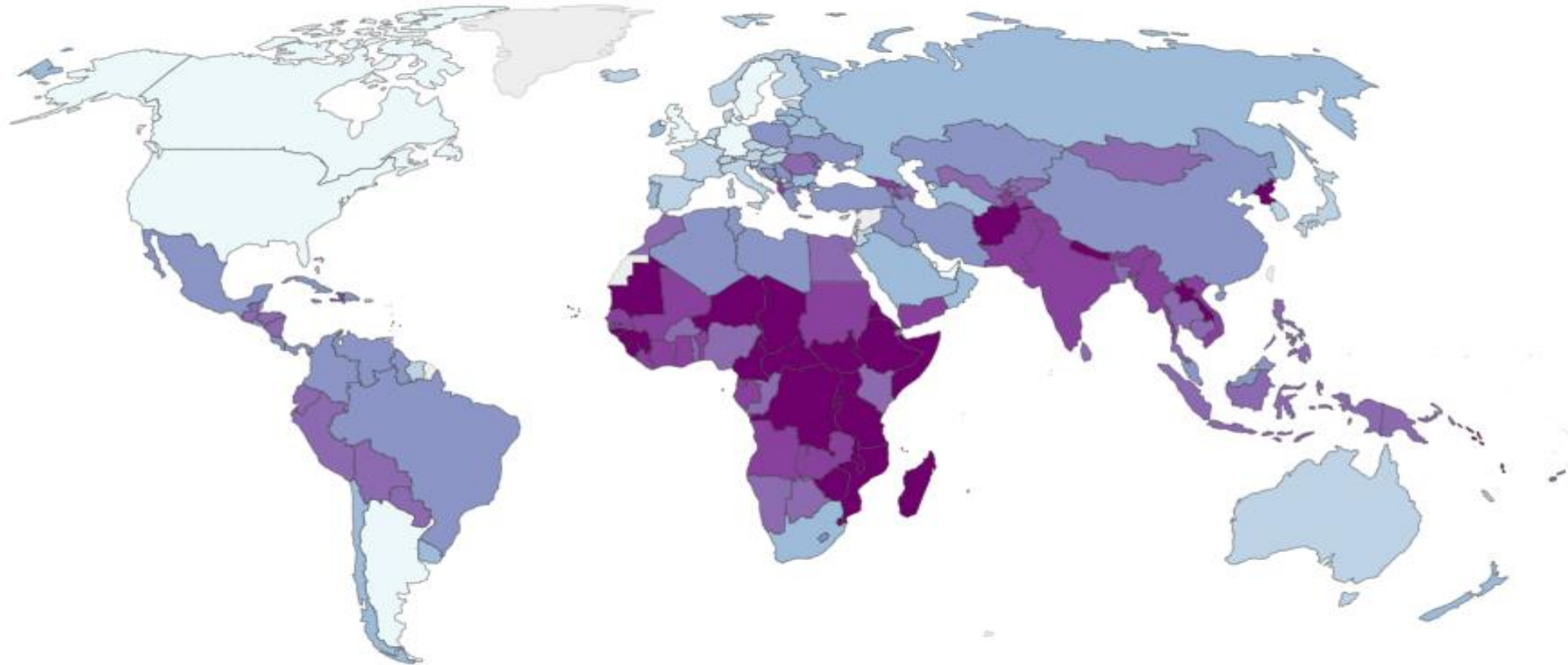


Employment in Agriculture

Share of the labor force employed in agriculture, 2017

Share of persons of working age who were engaged in any activity to produce goods or provide services for pay or profit in the agriculture sector (agriculture, hunting, forestry and fishing).

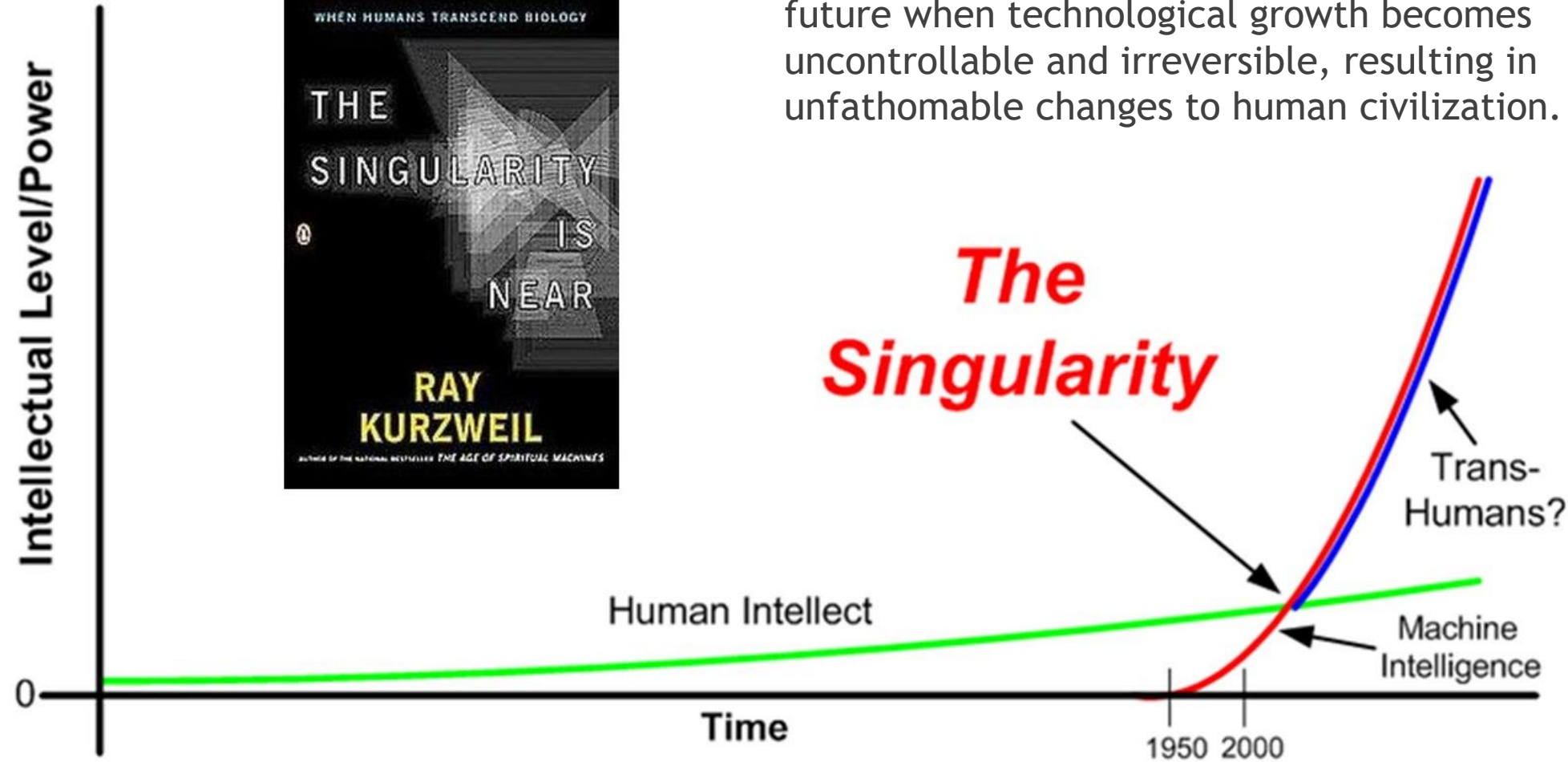
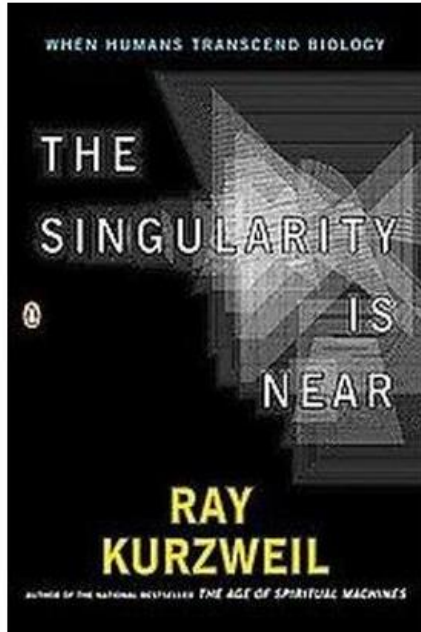
Our World
in Data





The Singularity

- ▶ The technological singularity (also, simply, the singularity)^[1] is a hypothetical point in the future when technological growth becomes uncontrollable and irreversible, resulting in unfathomable changes to human civilization.





Requirement Analysis for hydroponics automation

Needs Analysis – paper & interview

Why Robotics on Farming ?

- Very poor workers environment
- Labor power shortage, Labor cost down
- Efficiency improvement

Local Farm Interview, Smart Farm (As-Is) ??

- Positive: Several visit to farm sites - Automation needs are discussed for **hydroponics** > they think automation could help to solve farming problem.
- Negative: MK hydroponics farm case.
: smart farm technology now is not enough they think
- Automation? Human is better ... negative view from labor



, Standard Process ?

- From crop to detail process, we should analysis.
- Focused on the hydroponics process
- Crops Selection

Automation Method Selection

- The Optimized Tool Selection to each process
- ROI discussed



Where are the technology being used

WHERE ARE THEY BEING USED

ROBOTS

- Automated harvesting systems
- Weed control
- Autonomous systems for navigation in the fields
- Mowing, pruning, seeding, spraying and thinning
- Nurseries
- Rowcrop, vineyard, and orchard applications
- Sorting and packing
- Agricultural robot platforms



DRONES

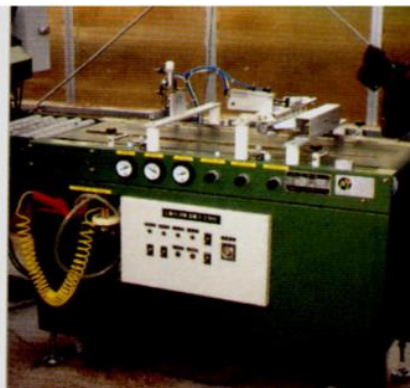
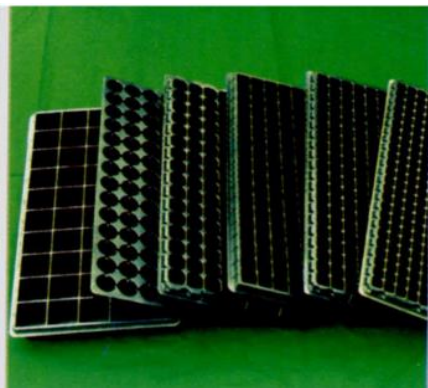
- Precision agriculture
- Survey farm land
- Remote sensing and mapping fields, crops and land
- Multispectral measurements for site-specific land development
- Analysis of soil, health and vigor of crops
- Agricultural development, irrigation and nutrient management
- Fertilizer and pesticides measurement
- Environmental impact assessment and flood risk surveys



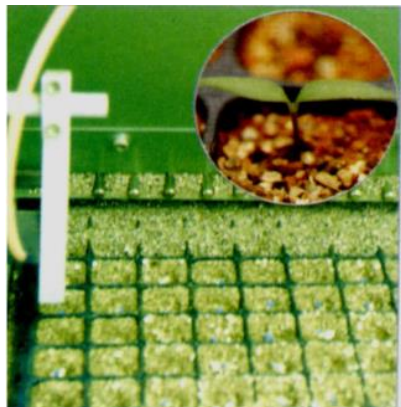


Hydroponics Process Study

- ▶ It is now hard labor process from seeding to harvesting without automation ...



Media | Plug Tray | Seeding



Germination | Transplant | After Transplant > Harvest

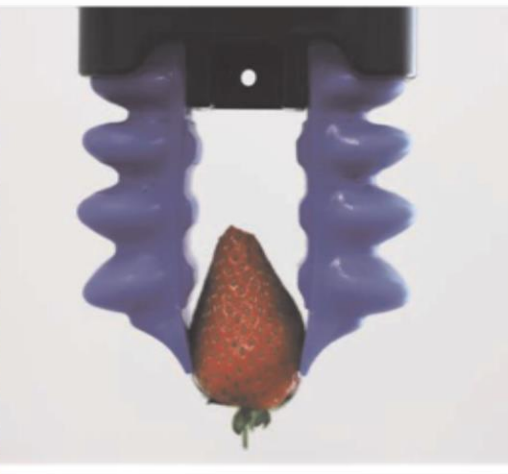
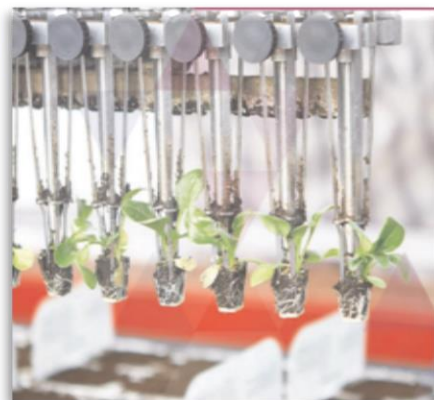


Robotics On Agriculture

Agriculture Automation

Human Labor Power replace & automate

- ▶ Environment control, Seeding, Transplanting, Harvesting ...





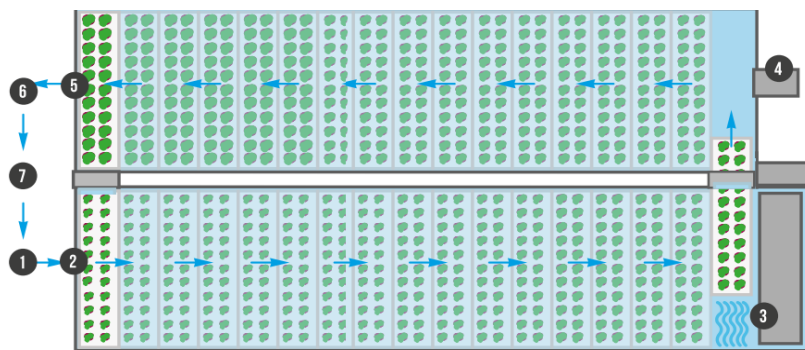
hydroponics case

Process analysis, Automation with Tool selection & Design, Mockup



- Understanding of hydroponics Process, Pain Factor

- B/M , efficient System Tool



TRANSPLANTING

Transplant automation needs,
Grow Tray & Grow Cup design



INFEED SYSTEM

Infeeding automation



AUTOMATED PUSH-UP MECHANISM

efficient Transport system



Process Analysis & Technology

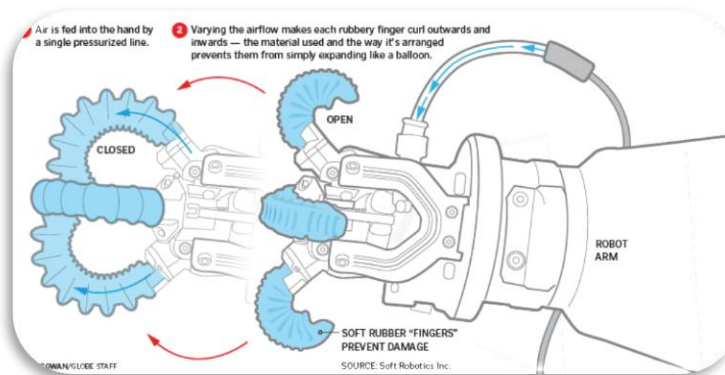
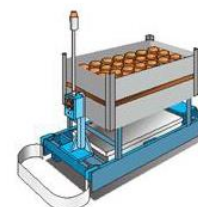
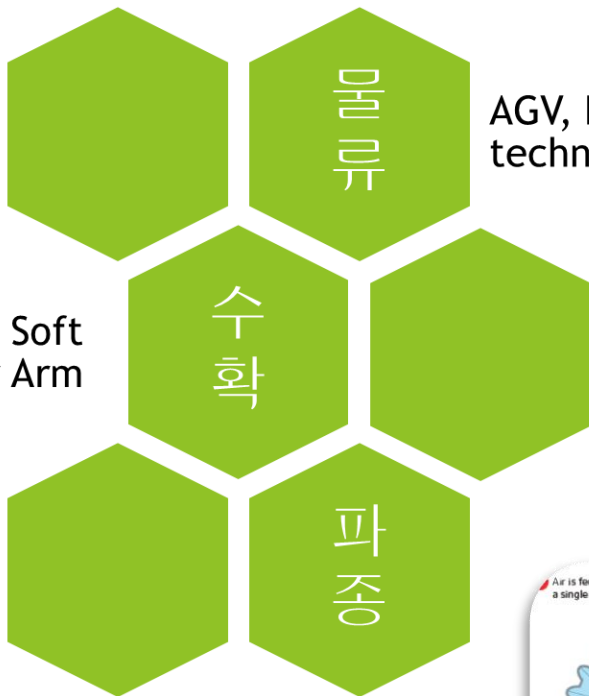
Robot Needs – human resource, labor power everyday

농업 자동화 사례

파종, 육묘, 수확 등 노동력이 요하는 분야 자동화 사례 분석



Flexible Soft Gripper Arm



Transplanting On Hydroponics

Hydroponics Automation Research – Transplanting

- Grow cup design - optimum grow condition needed, design for automation
- grow tray & grow box handling
- Move to new environment after Germination
- Moving floats / transplanting



Transplanting On Hydroponics

Hydroponics Automation Research – infeed

- Seeding - Growing - Transplanting - Harvesting - Washing - Packing
 1. Transplant > Cup transfer from Tray to new Float Bed
 2. Float Bed transfer to water. Infeed
 3. Float Bed movement, Belt type Automated Push-Up





Vertical Farm ? (As-Is)

- ▶ This is not the correct way as we think (As-Is)
- ▶ Too much cost & heavy water treatment, too many labor power needed

이런 식으로는 될 수 없습니다



- Too much cost for automation
- Personal Carrier Lift is too risky
- Very heavy water treatment
- Difficult for Cleaning & repairment
- ROI problem

일반적인 입체재배의 예

문제점



Farm Automation Case

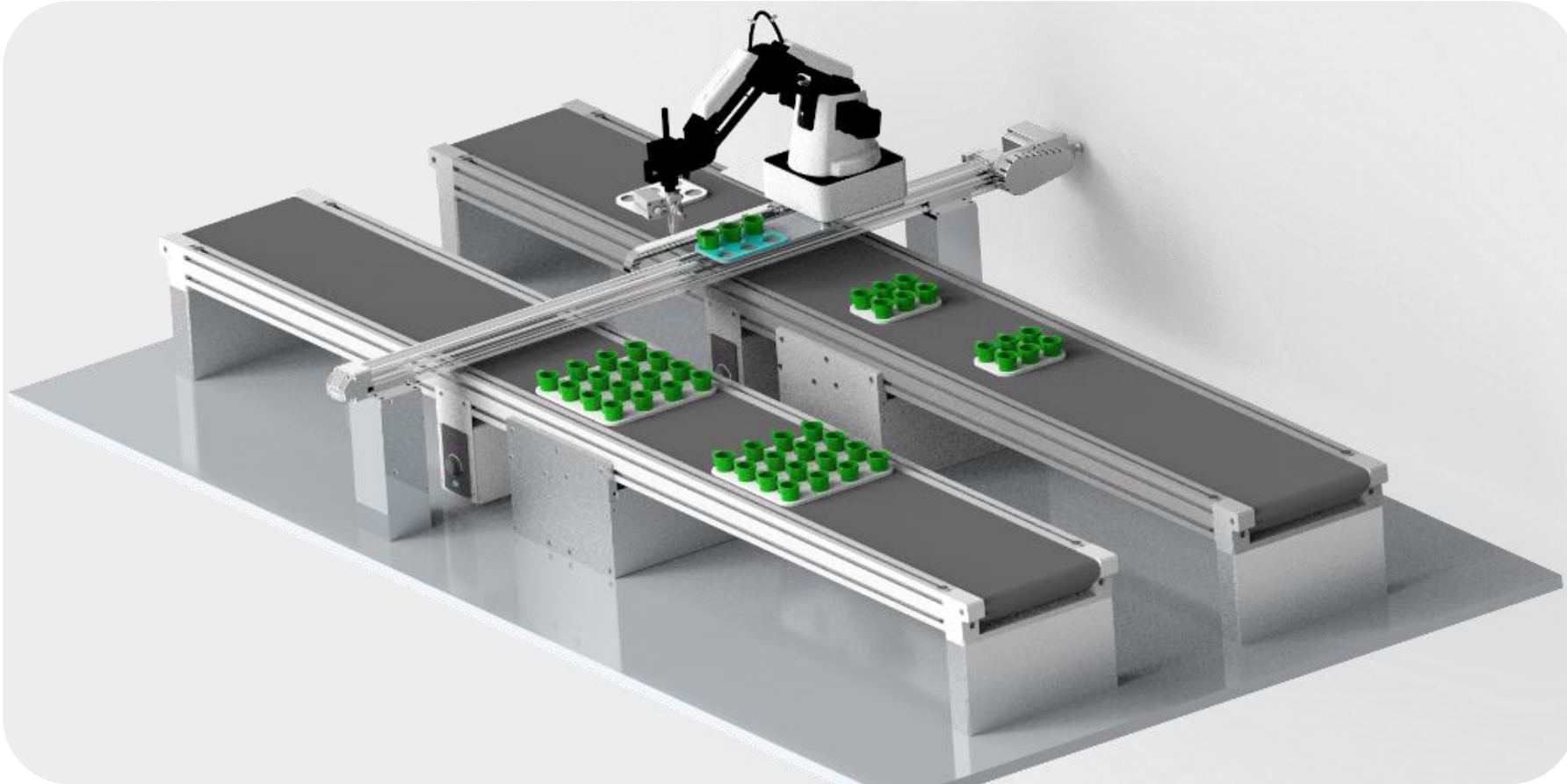
- ▶ K-Plant Automation R&D
- ▶ Cost Saving, Cost Effective Design
- Closer Consumer to Farmer distance
- ▶ Every Season, Every month Harvest,
Modular Automated Farm Design
- ▶ Farm8 case in South Korea





Robotics On Transplant Automation Process

- Robotic Arm, Rail, Conveyor belt system





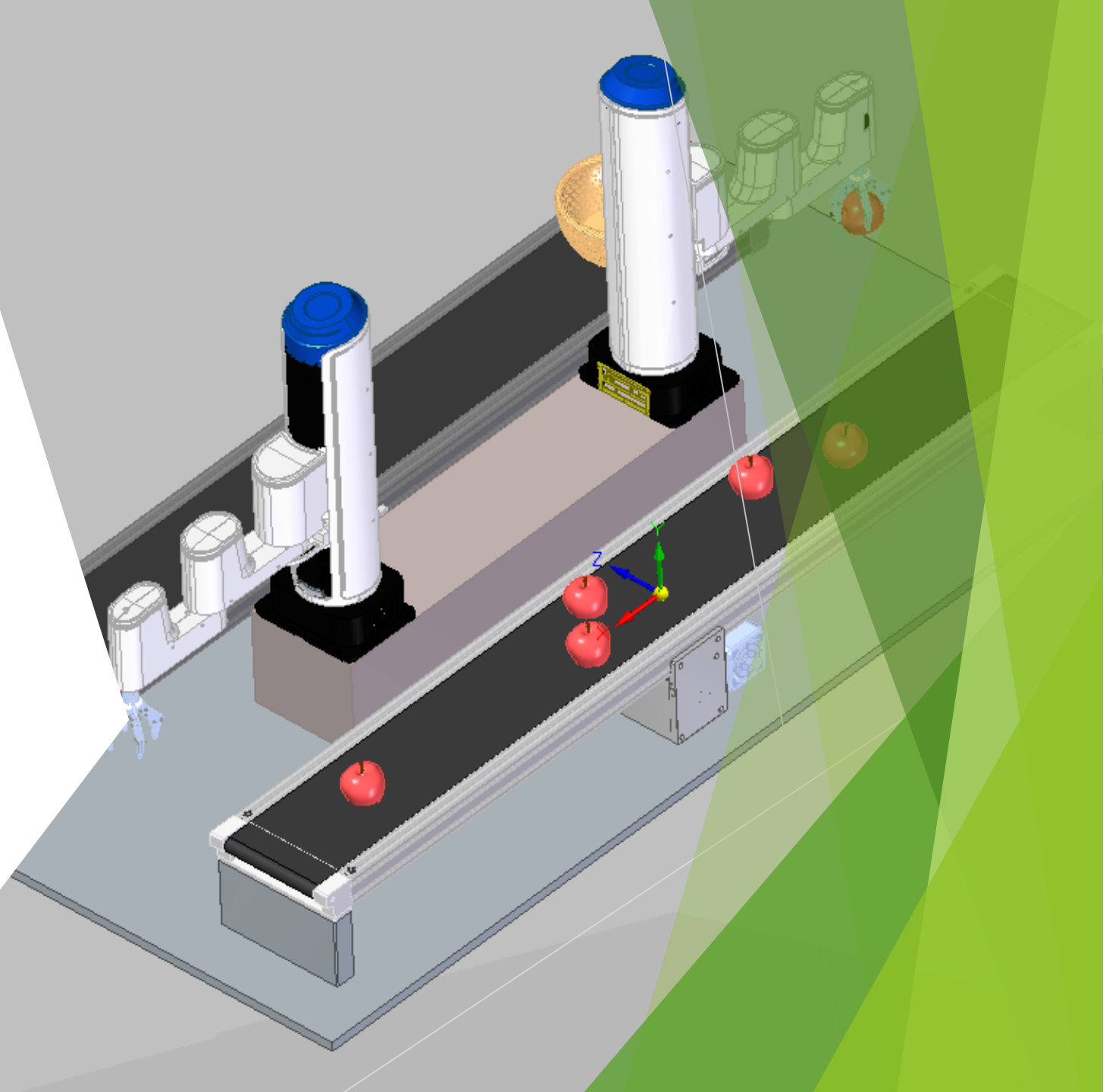
Robotics On automatic sorting & boxing

▶ SCARA ROBOT 2, Vision 1, Conveyor belt 2

* Vision + 각종 작물의 수확자동화

* Concept Design :

Solid Edge ST10 3D CAD 이용





Harvest Process Case

수확작물을 다루기 쉽게 구조화 필요.

➤ Apple, Tomato by vision recognition and robotic gripper

Recognition

- Detection
: Find mature fruits
- Location
: Guide to reach them

Cut & Pick

- Grasp
: Gently hold
- Cut, Remove
: Detach it from the tree

Place & Deliver

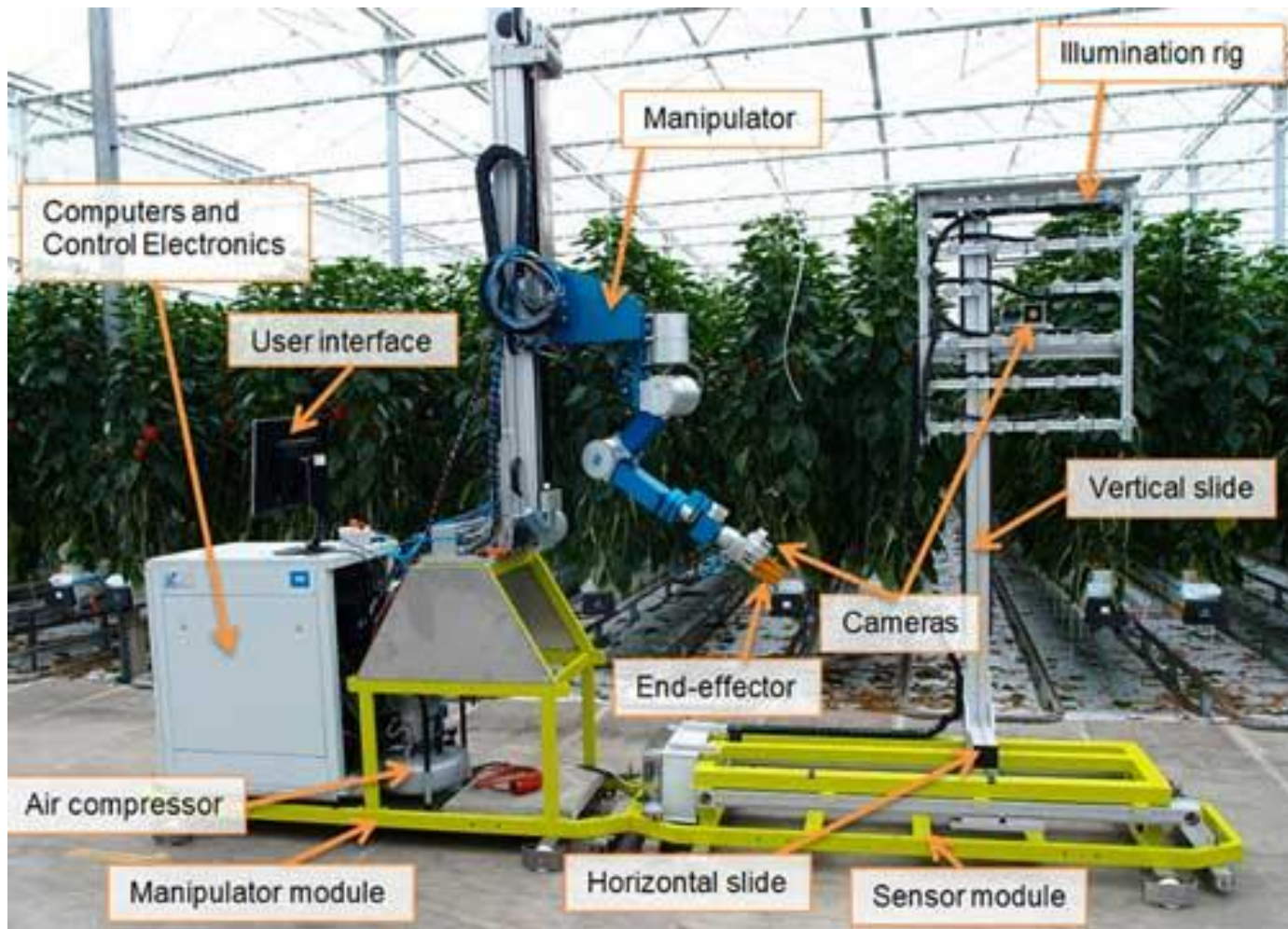
- Place
: Release the picked fruit
- Deliver
: in Container





Harvest Process Case

➤ Harvest Automation / Orlando ... its not nice now



- Fruit shaking harvest robot
- Bin managing robot
- Vegetable weeding robot
- Asparagus harvest robot
- Smart spraying robot
- UAS bird deterrence robot

➤ Apple picking robot

Robotics On hydroponics Case,, Iron Ox Case

- This Hydroponic Farm Is Run Entirely By Robots



- Iron Ox has just opened its first fully automated farm in San Carlos, California.
- The company claims that their hydroponic system can produce 30 times the yield per acre of land comparing to traditional farms, while using 90% less water.

The robot arm uses stereo cameras to identify the plants and move them carefully from vat to vat. | Photo: Iron Ox

blob:<https://www.wired.com/9c401672-a104-4959-869c-8d30b777097f>

<https://www.youtube.com/watch?v=q1ieL7x3AMg>

Robot porter



Meet Angus, Iron Ox's robot porter, which is designed to move pallets of plants around their indoor farm.

26

Automated Hydroponics, K-farm model



상추 뿐 아니라
다른 여러 작물도 기릅니다

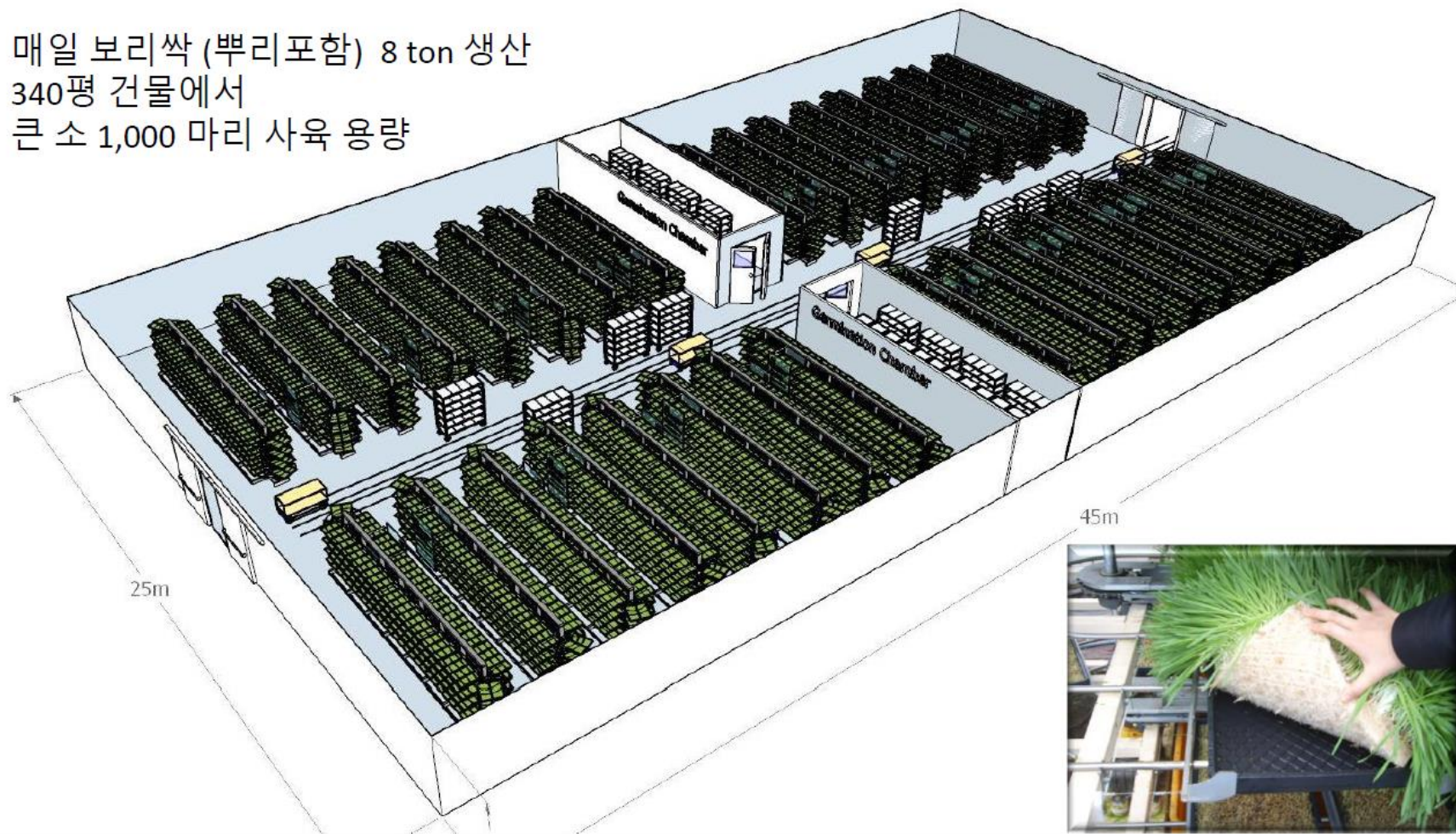




Design Case for yearly Bulky feed production

연중 대량 조사료 생산의 예

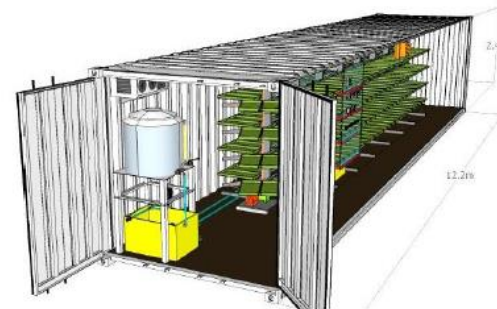
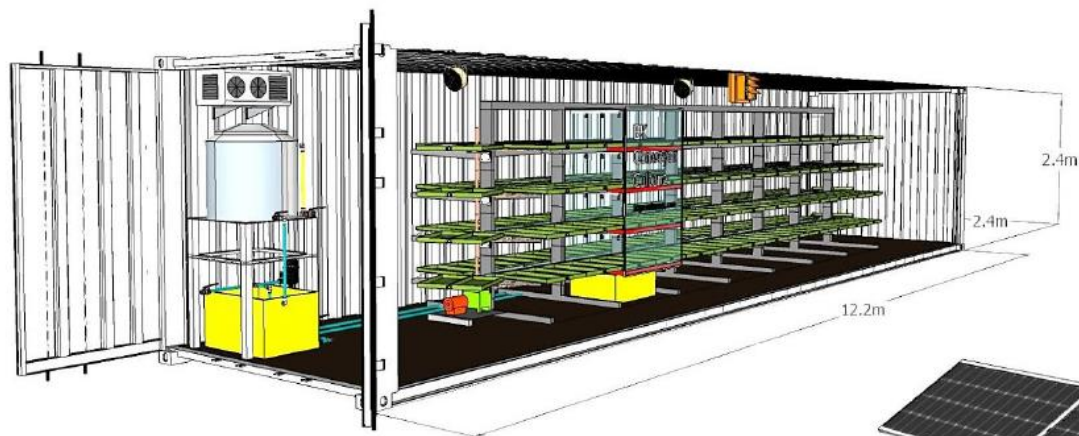
매일 보리싹 (뿌리포함) 8 ton 생산
340평 건물에서
큰 소 1,000 마리 사육 용량



Robotics make the bulky feed production possible for daily 8 tons in 25x45m² area : this could feed 1000 cow.

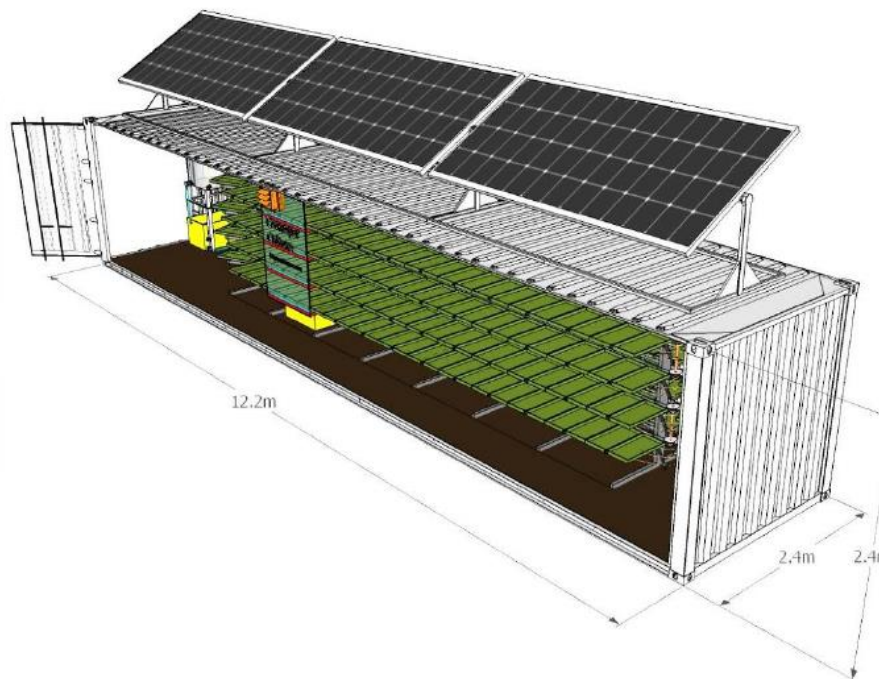


Container Module Design



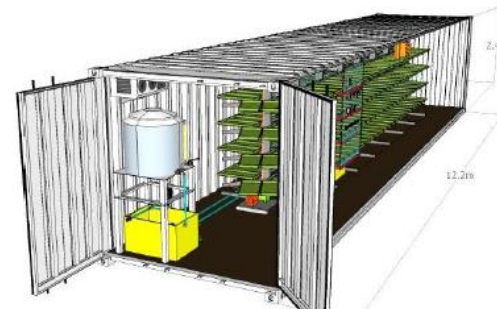
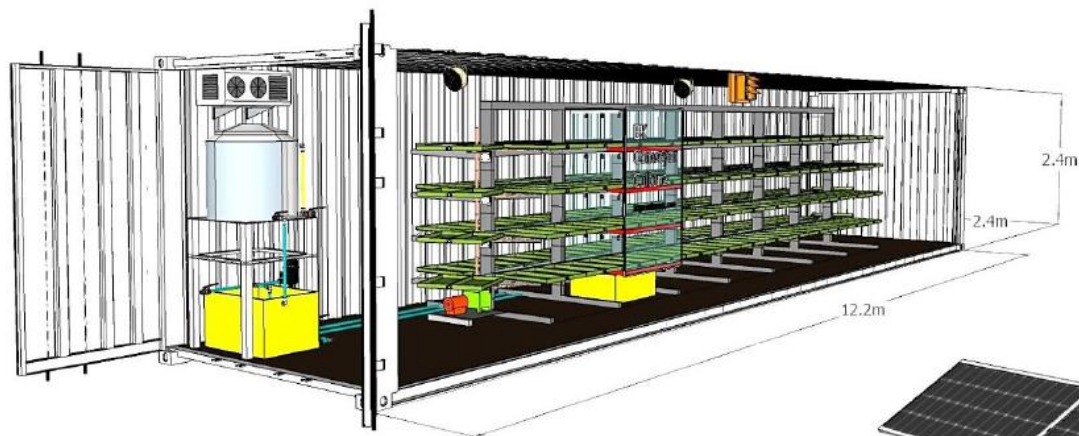
- 물 전기 연결하여 바로 생산
- 내벽 천정 단열재 사용
- 급수 환경제어 자동화
- 물세척 바닥 코팅
- 태양 전지판 지붕설치 가능 (선택사항)

- 트레일러로 쉽게 이동



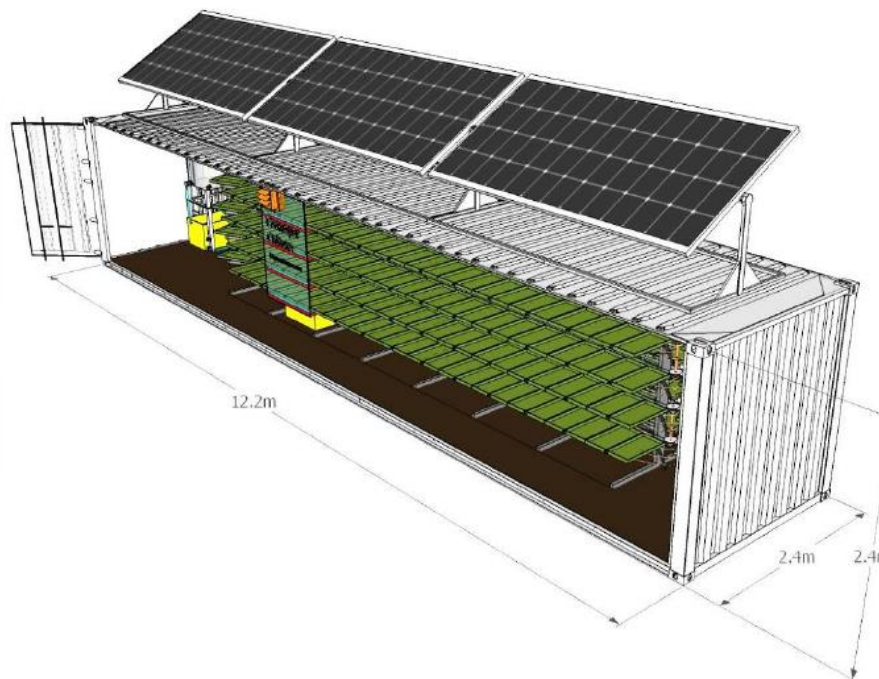


Container Module Design



- 물 전기 연결하여 바로 생산
- 내벽 천정 단열재 사용
- 급수 환경제어 자동화
- 물세척 바닥 코팅
- 태양 전지판 지붕설치 가능 (선택사항)

- 트레일러로 쉽게 이동



Thank you.



ROBOGATES

The Gateway From Future

