

# Crop Farming and Smart Irrigation



## Basic Knowledge

Li Ming

2018/10/15

# The Way of Modern Farming

There are mainly three ways of cultivation for agriculture.

**American model**

European model

Asian model

Cost less Harvest more



American model

## Large scale, mechanized and high technology mode -- American model

Suitable for large scale farms -- Open planting.

Crops - sugarcane, citrus, wheat, potatoes, corn and so on.



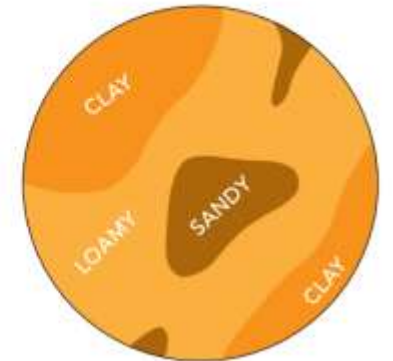
The market information, production parameter information (climate, soil, seed, agricultural machinery, fertilizer, pesticide, energy, etc.), capital and labor information are integrated to select the best planting solution. In the growth process, according to the local microclimate changes in different plots, adaptive irrigation, fertilization and so on, agricultural production tends to be industrialized and automated.



VARIABLE APPLICATION RATES FOR CROP, SOIL TYPE, TOPOGRAPHY AND OBSTACLES



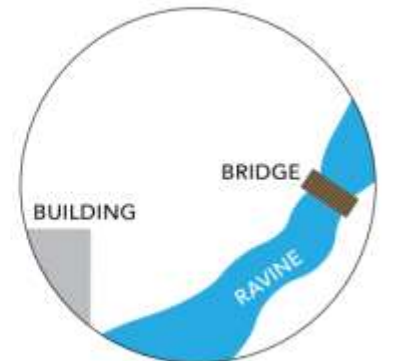
DIFFERENT CROPS



VARYING SOIL



LOW/FLOODED



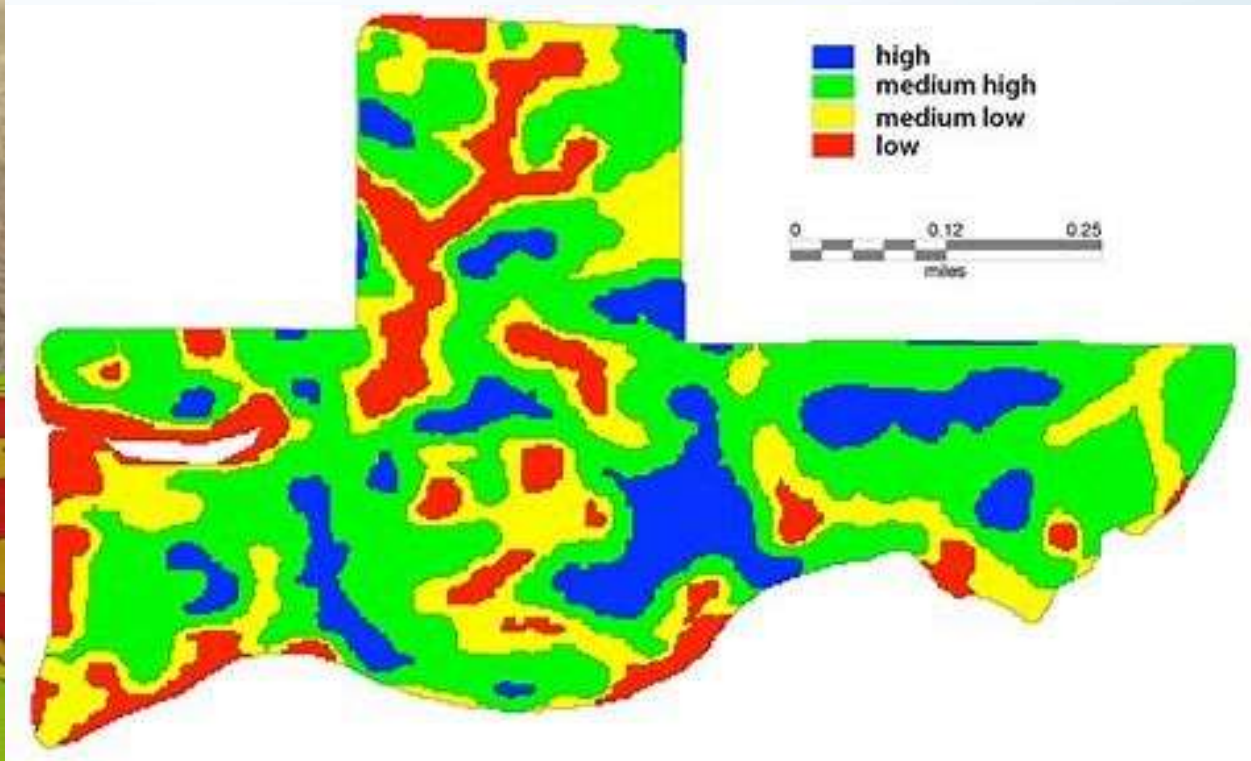
FIELD OBSTACLES

Cost less Harvest more



# Precision fertilizer application

- Precise Placement and Variable Rate Fertilizer Application Technologies for Crops



# Precision fertilizer application





Cost less Harvest more



# European model

Cost less Harvest more

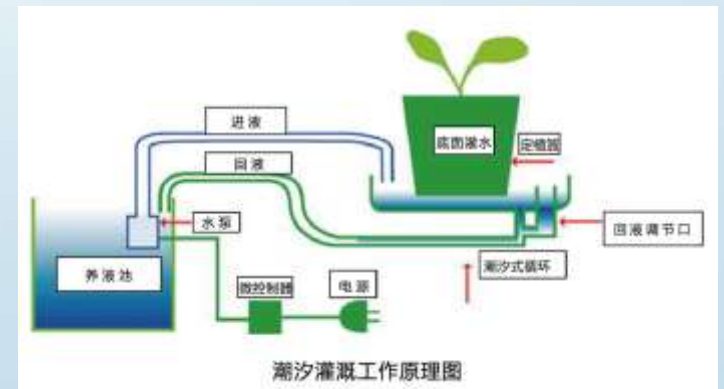


# Hybrid of production intensification plus mechanical technology - European model



# Tidal planting

Tidal planting is an efficient planting model based on the principle of tidal fluctuation. It is suitable for the management of all kinds of potted plants and can effectively improve the utilization efficiency of water resources and nutrients.



# Nutrient solution planting- shallow liquid flow

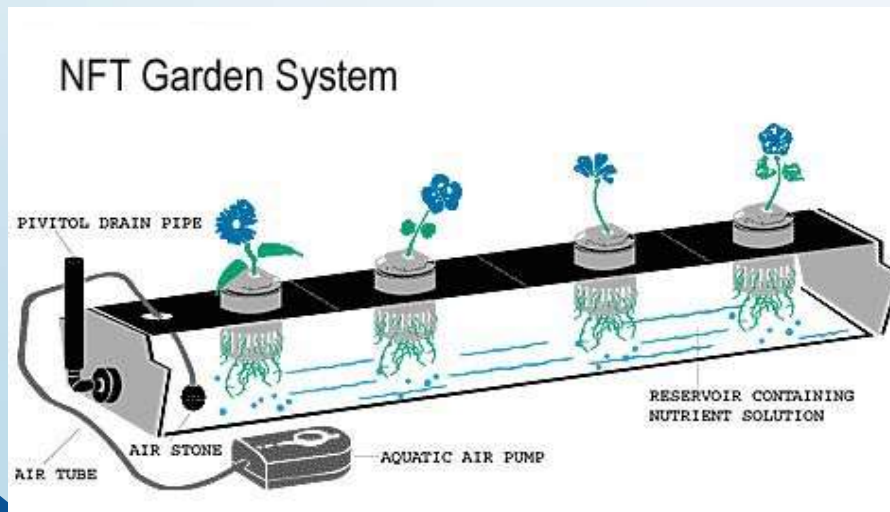
Cost less Harvest more



A thin layer of nutrient solution (0.5-1cm) circulates through the roots of crops, continuously supplying water, nutrients and oxygen.

**Advantages:** it solves the problem of oxygen supply very well.

**Disadvantages:** low nutrient solution, shallow liquid layer and large environmental impact.



# Nutrient solution planting -deep liquid flow

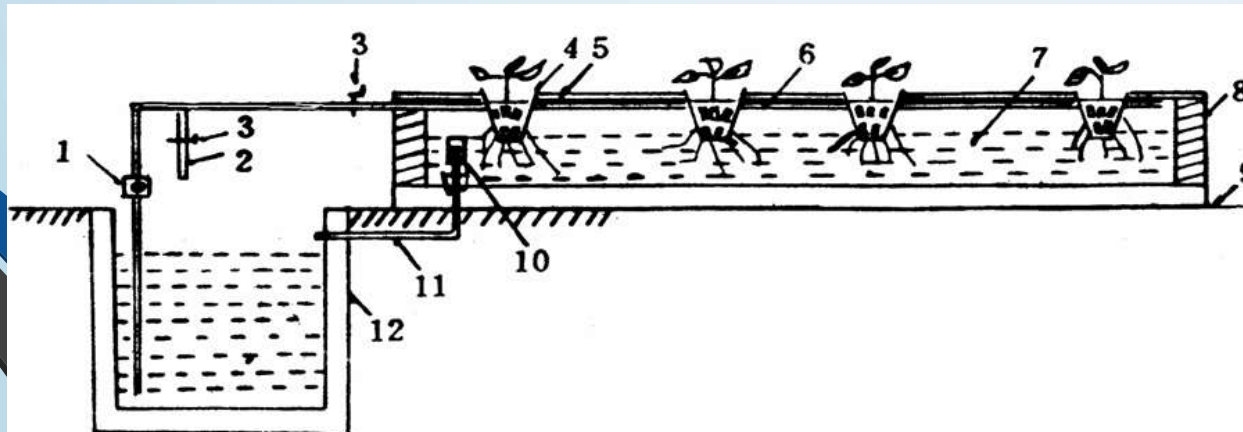
Advantages:

“Deep”: full of nutrient solution.

“Flow”: circulating flow of nutrient solution

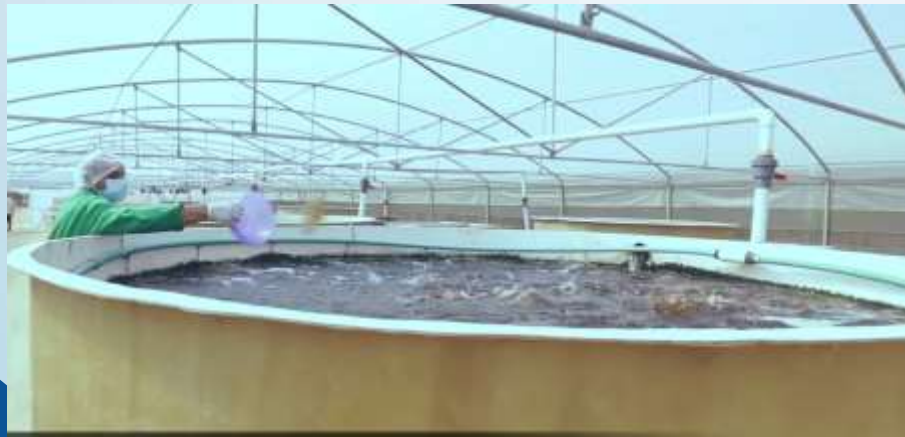
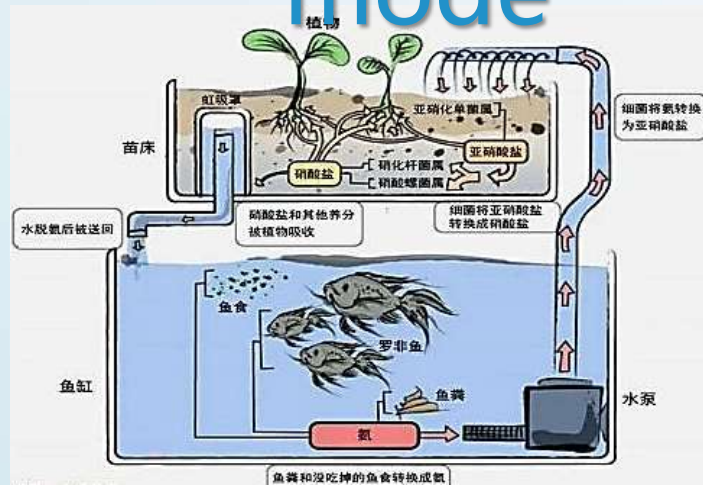
“Suspension” : suspension colonization

Disadvantages: high investment; easy to cause disease; high management and technical requirements.



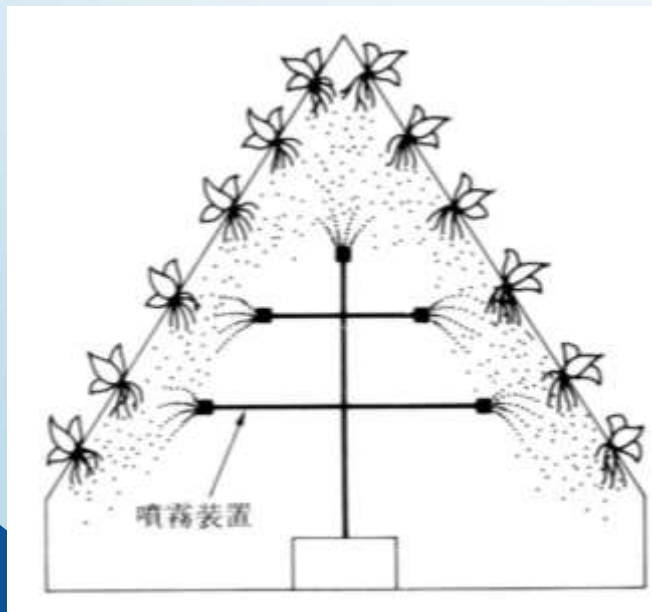
# Fish fruit / vegetable symbiotic planting mode

Cost less Harvest more



# Aeroponics

- The nutrient solution was transported to the root in the form of fog and solved the contradiction between water and gas supply.
- It is easy to fulfil automatic control and vertical cultivation, and has high utilization rate of fertilizer and water.



# AQUAPONICS



- Fish and vegetable symbiosis (Aquaponics) is a new type of compound farming system. It uses two different farming techniques, aquaculture and hydroponics, to achieve scientific symbiosis through ingenious ecological design, so as to fulfil fish farming in water without changing, vegetable cultivation without fertilization. The Ecological Symbiosis on growth.



# Compound farming



- **Efficient utilization of light: rational frame type.**
- **Saving resources: water saving cultivation and fertilizer saving technology**
- **Environmental friendliness: reducing nutrient emissions, reducing vegetation damage and improving soil structure.**



The root confinement and rain shelter cultivation

# Artificial soil cultivation





# Asian model

Cost less Harvest more



# Resource saving, capital and technology intensive mode: Asian model

Desert water saving planting mode



# High technology intensive farming mode

Crop industrialized planting mode

Cost less Harvest more



Cost less Harvest more



# Automatic lifting and planting mode



# Aerial garden planting mode





# Smart Irrigation Technology

Future irrigation



**SMART**  
IRRIGATION



**S**ustainably  
**M**anaged,  
**A**ccountable,  
**R**esponsible and  
**T**rusted irrigation

Cost less Harvest more



# What is the Internet of Things (IoT)?

- The Internet of things is the Internet that connects objects to objects.
- First, the Internet of Things is still used the core and foundation of Internet; secondly, its user-side extends and extends to any equipment and objects, with information exchange and communication, that is smart with sensors.
- The Internet of Things (IoT) is the application of the Internet. It is not so much a network but as business and application. Therefore, application innovation is the core of the development of the IoT, and Innovation is the soul of the development of the IoT.

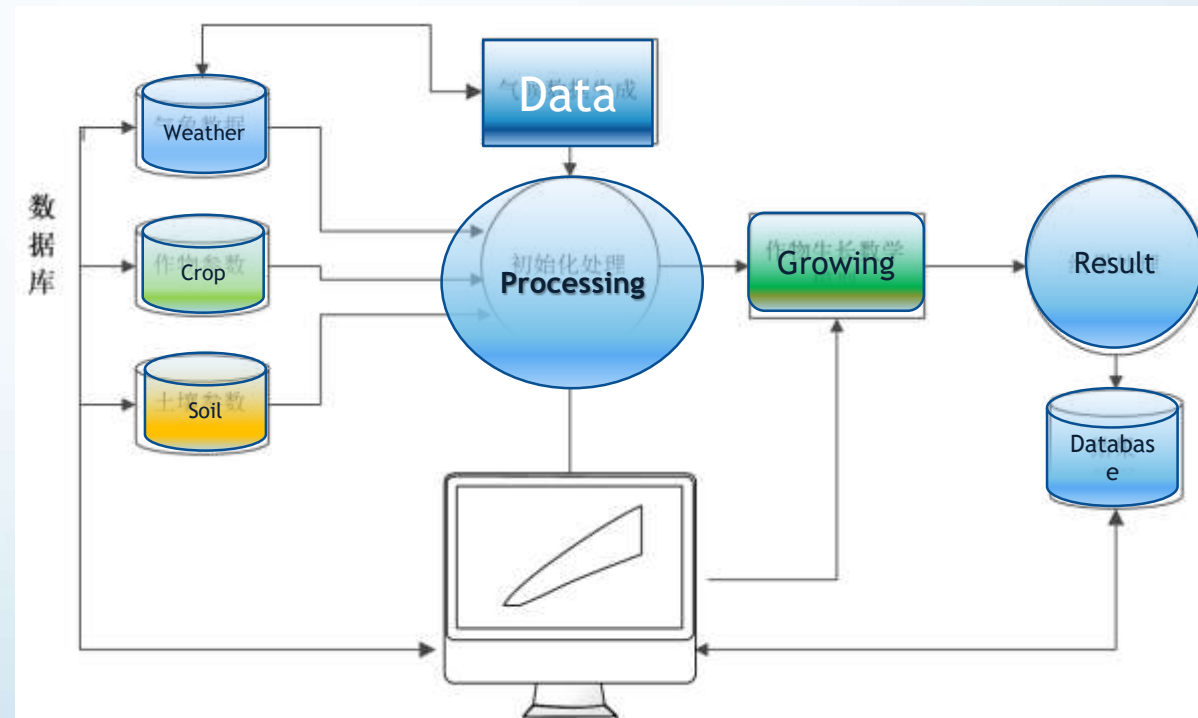


# Smart Irrigation

- Smart Irrigation is advanced irrigation system. It can not only irrigate crops according to the amount of water they need, but also optimize and make irrigation decisions in advance according to the water requirement of crops in different growth stages.
- Water-soluble fertilizer is applied timely and appropriately through integrated water and fertilizer system (Fertigation). The system understands the timely and appropriate use of water and fertilizer.
- The basis of the system is that it has smart sensor of IoT. From sensors it can judge the state of the crop. Then, according to the nutritional requirements of the crop growth model, it can judge how much water to be used, what fertilizer are used.

# Irrigation decision control for crop growth

- Crop parameters from crop database
- Soil parameters from soil database
- Weather data from meteorological database
- After initialization, the mathematical model of crop growth is calculated.
- Irrigation models make precise irrigation decisions.
- Data output is used to feedback the irrigation decision results, and the evaluation results are adjusted to irrigation decisions.



# Smart Fertigation

- The irrigation: The starting time of irrigation is determined by agronomy, fertilization or irrigation. According to the crop growth schedule set in advance, and then automatically crop water consumption changes by according to crop environmental conditions. The amount of irrigation water is given through irrigation decision module.
- The fertilizer: Based on the decision of fertigation in the system platform, precise control of fertilization timing and fertilizer amount was determined. The variety and quantity of water-soluble fertilizers applied through irrigation system can be formulated and applied according to the operational guidelines provided by Agronomic technicians or fertilizer manufacturer to verify the crop fertilization time and amount. Fertilization can be applied to demand elements and quantity according to soil formula. The amount of fertilizer can also be determined according to crop yield.



# Analysis and Simulation

- Mathematical models of crops are constructed by means of statistics, mathematical logic.
- Meteorological mathematical model is based on the collection of meteorological data, and it uses forecasting data or certain restrictions on random generation method to build.
- Soil mathematical model is setup by the method of water and soil balance with mathematical language in crop water usage.



# Intelligent Farming

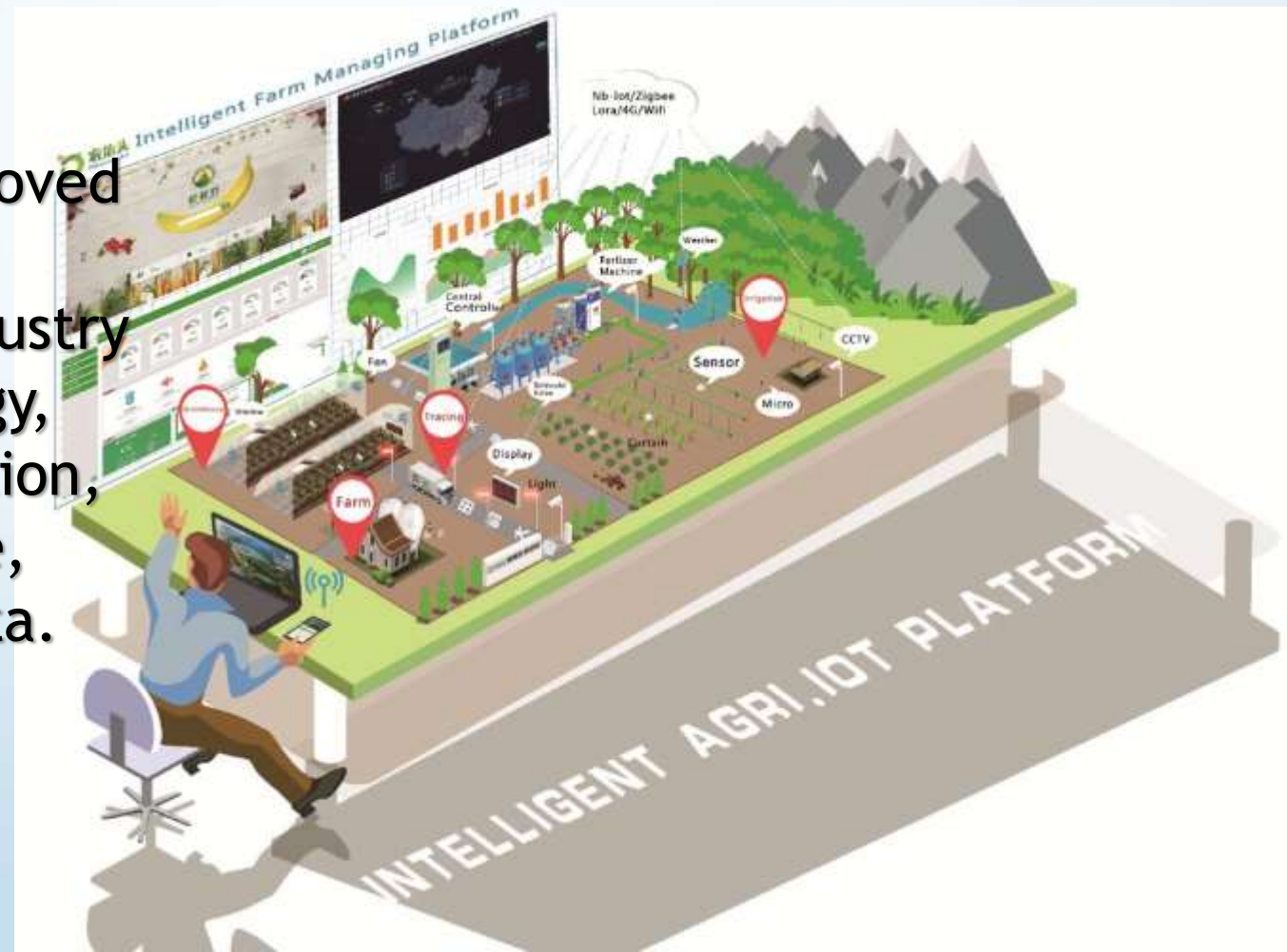
- Intelligent farming software solves the problem that the growth of crops need to give the agronomic operation time according to the agronomic and agronomic operation requirements of crop growth period, and automatically send and remind users to carry out agronomic operation. The software system needs to be customized according to crop varieties.
- Intelligent farming software is a server software running in the cloud. It can provide images, pictures and data of normal state of crop growth under local and growth environment parameters through the IoT. Users can know the difference between the state of own crops and the standardized farm by computer and mobile phone at any time, find out the problems existing in their own planting, and promote the popularization of agricultural standardization and industrialized production.





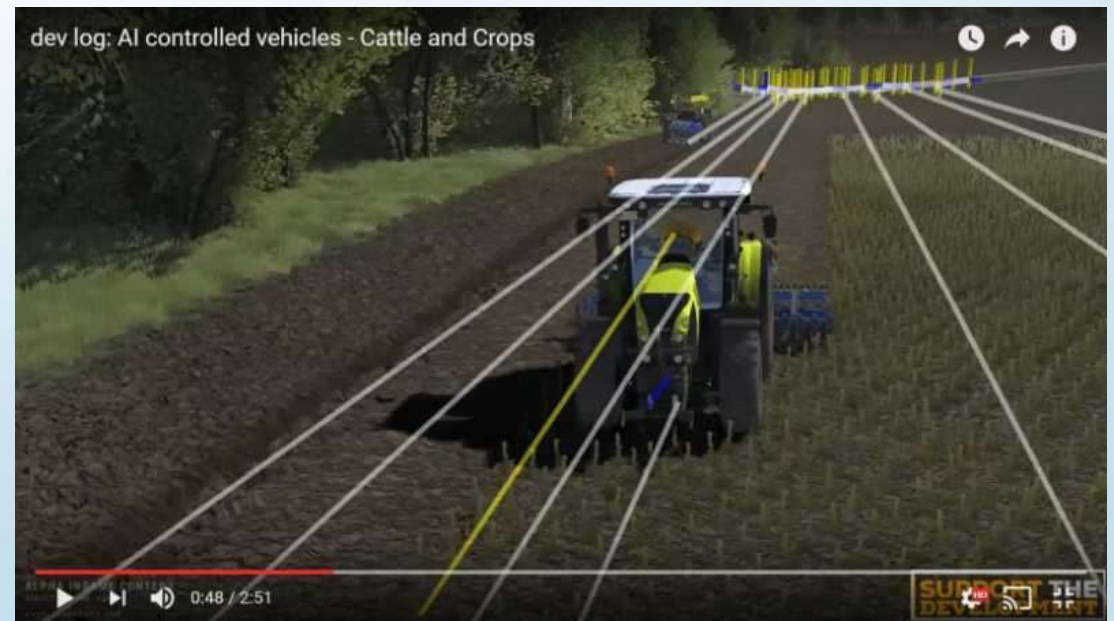
# Big Data

- The intelligent agricultural production can be greatly improved by mining the big data of agricultural production and industry information such as meteorology, soil, crops, irrigation, fertilization, production, consumption, price, scientific and technological data.



# Artificial Intelligence in the Agricultural Industry

- Agricultural Robots - Companies are developing and programming autonomous robots to handle essential agricultural tasks such as harvesting crops at a higher volume and faster pace than human laborers.
- Crop and Soil Monitoring - Companies are leveraging computer vision and deep-learning algorithms to process data captured by drones and/or software-based technology to monitor crop and soil health.
- Predictive Analytics - Machine learning models are being developed to track and predict various environmental impacts on crop yield such as weather changes



# AI have "independent thinking ability".

Smart irrigation is a more intelligent and precise implementation of high efficient irrigation.



Cost less Harvest more



Thank You!



Question?