

A Study on Agricultural Supply and Demand, Stabilizing the Model using the NFC

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Abstract

Agricultural product price fluctuation which has been periodically repeated for years is not just the issue of farmers who are the subject of the production but has close relationship with distribution institution, consumer, prices and agriculture policy making authority. But, most countries selected agricultural product distribution issue as the major strategy for agricultural product price stability. However, there is no successfully executed policy case because no in-depth analysis was tried regarding basic cause. Therefore, this study was conducted to identify stable agricultural product supply and demand plan through seeding information exchange between producers for stable agricultural product supply and demand plan. In order to exchange the information between nationwide producers, smartphone and NFC were used and this study was conducted to identify how to distribute collected information in central server to individual producers in the country.

Keywords: *We would like to encourage you to list your keywords in this section*

1. Introduction

Report of Yonhap News Agency said discard at production area was started according the stabilization policy of the government from 2014 April 25th.

Onion price fluctuation occurred 6 times every 3 years after 2000 and producer group is asserting ‘major production area protection special law’ should be enacted to give the benefits like production cost guarantee, cultivation technology provision and distribution structure preparation.

Like this, price decline problem caused by overproduction of agricultural products and rapid decline consumption has continued from the past and even though various solutions were sought, forward looking alternatives are not prepared.

The issue which is related with agricultural product price stability is not just our country’s issue but is one of global pending issues.

United States have been making various efforts to achieve this objectives starting from 1933 Agricultural Amendment Act to 2008 Agricultural Law.

Summarizing the results, agricultural product supply and demand balance should depend on price supply and demand adjustment function of the price because it is difficult to be controlled by the government level production adjustment. In addition, sharp price decline of agricultural products causes farmer’s income problem and therefore, the connection between government’s support system and market price cannot be completely blocked. Realistic alternative is to compensate for the income loss of farmers according to price decline by direct payment system, and not to destroy supply and demand adjustment function of the price and not being connected with production.

Regarding agricultural product distribution improvement of current government, the president said in 2013 March “distribution structure improvement like distribution channel reduction is a basic measure for agricultural product price stability” and ordered to prepare for the plans to realize improved effects. Subsequently, minister of Ministry of

Strategy and Finance announced to seek for multilateral plans to structurally stabilize the price through distribution structure improvement of the agricultural and fishery product.

But in 2014, "spring season products like radish, cabbage, garlic and onion showed price decline one after another and summer fruits like watermelon and oriental melon don't avoid weak price from early ship-out."

Stable agricultural product supply and demand is a measure not only to control market prices effectively but also affect people's dietary life and the entire industries of food processing companies and out-dining related companies as well.

Even though distribution structure improvement of agriculture and livestock products can limitedly contribute to price stability, this cannot be a fundamental prescription.

It is because agricultural product price is determined by producers, consumers and distribution procedures.

In 『Agricultural Product Distribution Structure Improvement Plan』 of Ministry of Agriculture, Food and Rural Affairs, three issues to be solved for agricultural product distribution issue are suggested including low efficiency distribution structure, high price variability and non-indexation between production area and consumption area prices. Regarding execution plans, alternatives are suggested including paradigm change in wholesale market, expansion of alternative distribution paths like direct trading, distribution systemization through producer group, systemization of supply and demand management, securement of trade fairness and expansion of information provision.

Because vegetables and fruits are difficult to be stored and greatly affected by the environment factors like climate and natural disaster, the prices are especially instable and speculative, and agricultural product auction system in distribution process is acting as one of the factors of price variability.

After comprehensive plan was announced, backup plans are prepared through policy workshop to compensate for agricultural product distribution structure improvement, but the effectiveness is questionable.

If the information sharing and forecast about expected selling prices could be systematically provided real-time from agricultural product seeding stage, most factors except agricultural product climate and natural disaster could be controlled in predictable range.

Therefore, basic plans should be prepared for stable agricultural product supply and demand and for this, comprehensive system should be constructed through various IT technology, human resource utilization and administrative network connection between producer, government and local self-government group

This study was conducted to suggest business model with the win-win between producers, distributors and consumers by systemizing local agricultural product production management system using NFC and preparing for basic plans for price agricultural product price stability.

2. Agricultural Product Supply and Demand Related Theories

Agricultural product fluctuation which has been repeating for years is not just a problem of the farmer who is the subject of production, but has close relationship with distribution institution, consumer, price and agricultural policy making authority.

But, most countries selected agricultural product distribution issue as the major strategy of price stability.

But, there is no successfully executed policy case because in-depth analysis about basic cause was not conducted.

As the reform and reduction at production area collection stage and wholesale stage could shift distribution costs to farmers and increase distribution expenses,

comprehensive and stepwise approach is necessary to find and determine the price and price control management, purchasing risk reduction and fair trade function.

Due to quick development and in Information and Communications area and internet supply, various types of direct trading are being executed. Among these trades, ‘local food shop’ or ‘local food bundle’ by Yongjin Nonghyup are regarded as typical agricultural product direct trading success cases and similar benchmarked types of direct trading are diversely being tried and part of these cases are reported to be successfully operated.

Table 1. Food Industry and Agriculture and Rural Development Plan

Division	2013 ~ 2014	2015 ~ 2016	2017 ~
Interactive personalized strengthen agricultural policy	- Agricultural management body building integrated management system (2014)	- Integrated DB escalation Rivers Project ('16) - Building Smart Farm Map (2015)	- Integrated DB-based custom Business Information Service - A policy decision-making system to build leverage Big Data
Provincial Agricultural Policy Activation	- Agriculture, Forestry and business reclassifications (2014)	- Local government funding system established (2015)	- Local agricultural projects tailored
Agricultural Policy Governance	- Nongeoep commerce pilot project evaluation (2013)	- Nongeoep enactment of Commerce ('15)	- Nongeoep nationwide spread of Commerce
Global Cooperation	- ODA assistance strategy (2013)	Asian Forest Cooperation Organization member states enlargement	- Securing foreign grain distribution
Agriculture and rural environmental protection and value empathy	Rural Resources Conservation Act enacted (2014) - Rural jeongbibeop revision (2014) World agricultural heritage ('13 - '14)	- Introduction of Rural Planning (2015) - The introduction of residents Convention Review (2015) - Ecomuseum pilot introduction (2015)	National Agricultural Heritage (25 places) - Rural toughness school (250 places) - Infant forest experience won (250 places) - Forest Education Centre (10 places)

But, there must be a limit to expand this small size success cases to the entire agriculture industry.

Therefore, basically new system is required to connect producers, distributors, producer, local government and central government.

Smart agricultural administration system construction road map of current government includes the expansion of local agriculture statistics information, construction of management DB for the benefits of producer and consumer convenience, customized agricultural administration to construct management DB, realization of local government administration to strengthen city and county development plan and connecting cooperation, agricultural administration

governance to fortify the participation and communication between agriculture producers and environmental problems and global cooperation and smart agricultural administration policies. Like table 1, smart agricultural administration policies are being executed.

Based on Information and Communications technology development, the government regards comprehensive management system and big data construction by agriculture management body and decision making process construction using big data as directing point. The system should be constructed to reflect the opinions of various agriculture related subjects sufficiently, but no specific plan is suggested.

3. NFC

3-1. Near Field Communication

Through NFC forum which was established by 3 companies of Philips, Sony and Nokia in 2004, standardization is being executed with the objectives to apply NFC technology to mobile phone and market expansion. Currently, more than 130 companies participate as a member company and in local market, Samsung Electronics and LG Electronics are acting as major leading member company.

While existing RFID service is mainly used for one-way service like history track, logistics distribution, NFC is applied in various application areas like mobile access service technology, personal information authentication, mobile advertisement and health care because it enables two-way communication.

NFC is one of RFID technologies and data exchange technologies between terminals which is non-contact type within 10Cm of close range distance in 13.56MHz frequency and doesn't use communication carrier network but directly communicates between terminals. This technology not only reads the information but also supports two-way communication to write as well.

Due to the development of NFC technology, using distance increased up to 900 meters including Passive Type and Active Type and its application range is expected to greatly increase according to business models applying reader and tag concept.

3-2. NFC Operation Mode

NFC operation mode is classified into three modes. First, P2P mode(Peer-to-Peer Mode) that supports link level communication between two NFC devices and its initial connection process is simplified by replacing Bluetooth pairing process with NFC technology and two mobile phones are operated as card reader and data can be transmitted between two devices and it has great amount of power loss.

Second, Reader mode(Reader/Writer Mode) NFC device can read and correct the data which are stored in NFC transponder. Like NFC tag information which is the control management subject, user's NFC device can check the information by reading tag.

When touching NFC mobile device in the tag where URL address is stored, it reads URL address and supports the access to related web site with that address.

Third, card emulation mode Because NFC device operates like smart card(ISO 14443), external NFC card reader cannot be classified into smart card and NFC device.

In this mode, non-contact type payment and ticketing service are possible. In real-time range control system, safer and more convenient log-in can be executed by transmitting the tag information in mobile NFC device to the server and authentication.

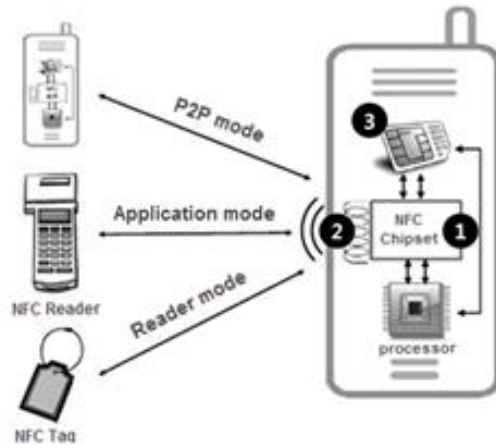


Figure 1. The Operation Mode of NFC

As NFC technology is combined with smart devices, directly communicating services between smart devices and offline services are possible.

Electronic wallet using NFC technology is being developed to integrate all services like driver license, health care, hotel key, concert ticket beyond the concept of electronic wallet.

Table 2. Comparison between RFID, NFC, Bluetooth

	NFC	RFID	Bluetooth
Setup time	<0.1s	<0.1s	<6s
Range	10cm	3m	30m
Usability	- . Easy - . Human Interface	- . Item Interface - . Easy	- . Data Interface - . Easy
Case of use	- . Payment	- . Item pursue	- . Data exchane
Consumer experience level	- . Easy connecting and touch	- . Require information acquisition	- . Require Network

In personal information management area, safe individual user authentication becomes possible by using personal information in the smartphone with NFC function and personal information exchange is possible through electronic name card.

Biggest reason why NFC technology receives more attention than other wireless data communication like WiFi or Bluetooth is that NFC technology is encrypted close wireless data communication.

If wireless internet infrastructure using NFC technology is constructed, various services can be infinitely applied in various smart environments like individual life and corporate business, entry electronic key service, tour guide, tour information guidance service(voice, text), patent’s medical service information, parking and electronic meter etc.

4. Suggested Model

Information about agricultural product harvest quantity which could not be forecasted until harvest time can be digitalized using NFC technology which is used in various areas. In addition, suggested model tries to prevent frequently occurred agricultural product

price fluctuation by forecasting agricultural product quantity which can be produced for a year by processing acquired information.

Agricultural product supply and demand plan scenario using NFC technology which is suggested in this paper is like Fig. 2.

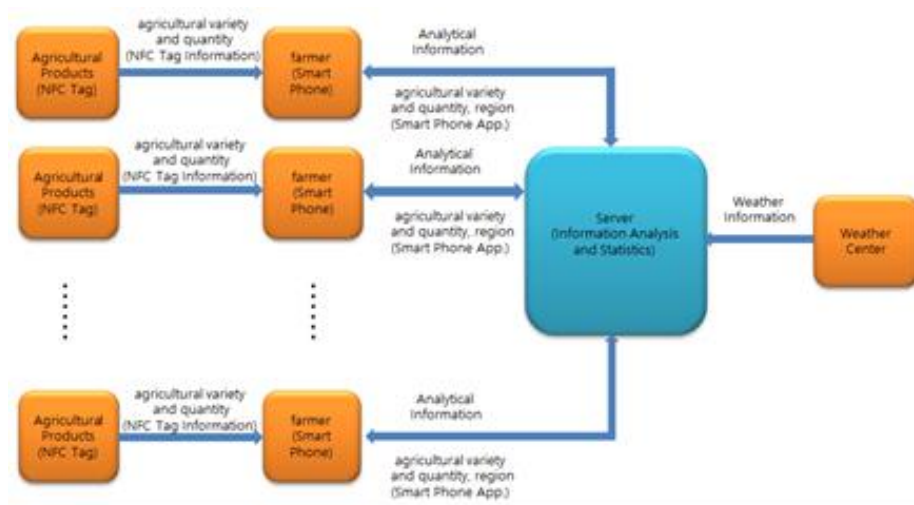


Figure 2. The Block Diagram for Proposed System Model

Seed quantity which is used at agricultural product seeding is collected in the server by using built-in smartphone which are used by most people and agricultural product quantity is forecasted which could be harvested at harvesting season using weather and climate information provided by National Weather Service.

Composition of agricultural product harvest forecasting system applying NFC which is suggested in this study is like below.

System is composed of sensor module, server module, client module and big data module. Fig. 3 shows the block diagram.

Sensor module is in charge to collect data through the sensor which is attached in production area and transmit collected data.

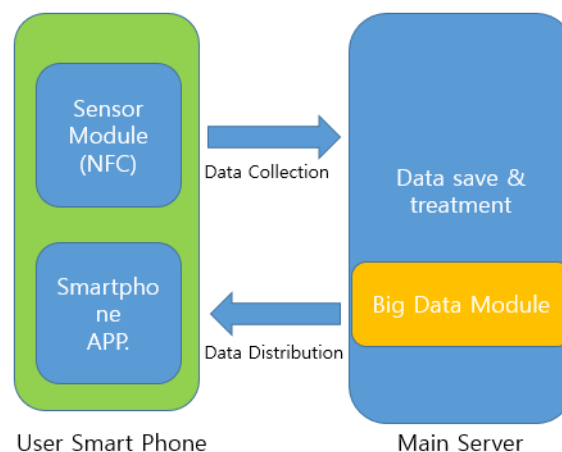


Figure 3. Proposed System Mode

It collects real-time condition information like measured temperature, soil humidity, atmospheric pressure and video information and collected data are transformed into numbers and transmitted to the server.

Server module sorts and stores transmitted data from the server and authorizes for stored data to individual users and provides the data to be used in the client.

Server module provides crop cultivation related orders like controlling the temperature by operating the cooler or adjusting the humidity by operating water pump motor and protects the crop from thieves or animals by using crop cultivation orders or alarm devices like siren.

Client module receives the data from the server which is made by combining video, temperature, humidity information and data from related institutions and enables to monitor the current states of the farm. Big data module stores the big data which is formed through the datafication of processes in the server and client.

In cloud server, stored data processes of many users are analyzed and best agricultural methods are selected. Selected agricultural methods are shared to many users real-time and if same situation occurs in the future, temperature, humidity and lighting are automatically processed without user order and just the results are reported to the user.

Fig. 4 shows data collection process which is made by the sensors at the production area. Collected data are transmitted to the users and enables to check the farm conditions real-time.

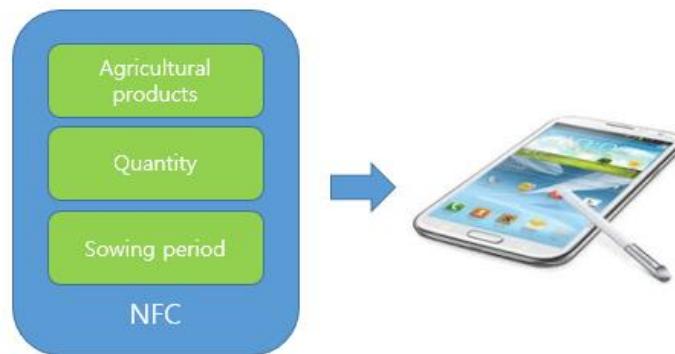


Figure 4. Information Acquisition Process

IoT applied system which is suggested in this paper is composed of sensor part and applied parts.

Fig. 5 shows data sensing part. WiFi shield is installed in micro-controller and sensor part is composed of temperature sensor, humidity sensor, ultrasonic sensor and gas sensor.

Device is manufactured by using sensor part and application part to generate data by the sensor. Manufactured device is installed and operated at farming area.

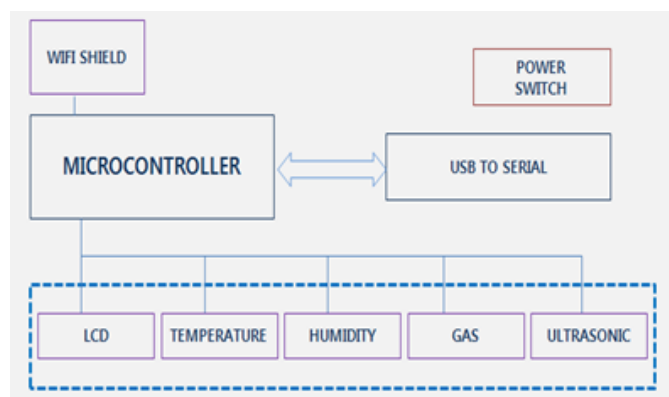


Figure 5. Part of the Farm Information Collection

4-1. Model Design for Data Exchange

For data exchange with mobile system, java server program is manufactured and java server and android client socket communication are used.

Fig. 6 shows control system diagram to interwork with database.

Farm_Login class authenticates id and password because system should be accessed through authentication process. If the authentication is successful, Farm_View() class is called and input id is transferred to mediating variables. Authentication test is executed by calling DB_Farm_Login() method in Db_Control class.

Farm_view class is in charge of farm condition views. Farm conditions can be identified through House_State() method including current temperature, humidity, gas and distance, and DB_Operation_State() method in Db_Control class is called by House_State() method.

When executing the control by hardware, Write() method is called through Farm_Hardware class. In called methods, set values are transmitted to hardware with the unit of byte.

Farm_Hardware class links logical control values to physically control the hardware.

It receives the information from the user which is required to connect and connects to relevant port. When connecting to the same port with hardware, each value is stored in database through Read() method.

Db_Control class executes the functions when acquiring, correcting and deleting the data from database.

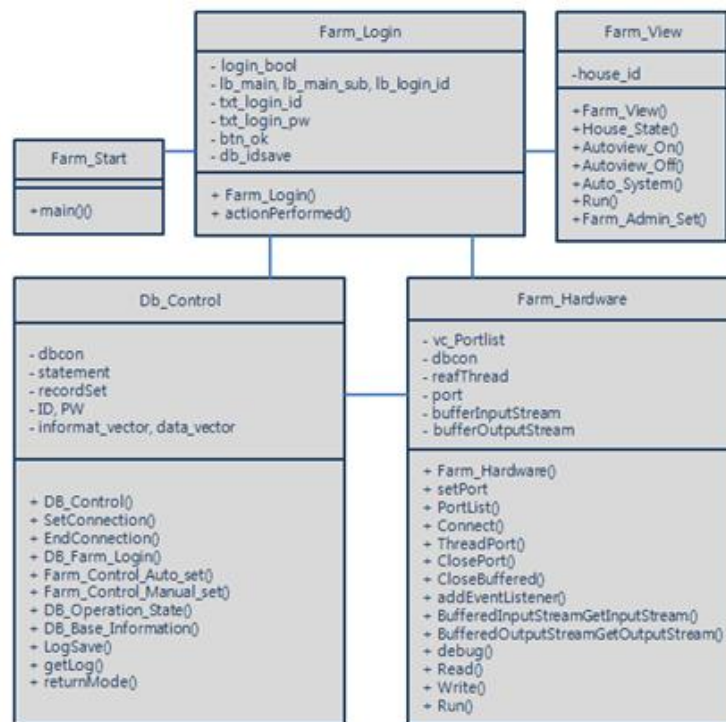


Figure 6. Control System Class Diagram

5. Conclusion

This study suggested system model to prevent agricultural product price fluctuation which is repeating every year.

Suggested model collects and manages various information about collected agricultural product by the producers.

This system provides real-time agricultural product item and quantity information which are currently seeded, and prevents future agricultural product price fluctuation by forecasting agricultural product quantity which can be produced in the year. For this, this study suggested a system model which collects agricultural product item and seeding quantity by using easily usable and less expensive NFC tag and smartphone which are used by most people, leads the producers to adjust production quantity by themselves through the feedback of real-time collected information and prevents frequently occurred agricultural product price fluctuation by forecasting the annual production quantity.

This study was conducted to suggest win-win model between producers, distributors and consumers by systemizing local agricultural product production management system using NFC and preparing for fundamental alternatives for agricultural product price stability.

Acknowledgments

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