

Service Model for Smart Farming Services at the Pre-production Stage

Soong-Hee Lee*, Dong-Il Kim**, Sok-Pal Cho***, Heechang Chung**

*Department of Electronic, Telecommunications, Mechanical & Automotive Engineering, Inje University, Korea

**Department of Information and Communication Engineering, Dongeui University, Korea

***Korea Institute of Science and Technology Information, Korea

icshlee@inje.ac.kr, dikim@deu.ac.kr, spcho@resear1.re.kr, gyoongchung@deu.ac.kr

Abstract— The Smart Farming services at the pre-production stage are important in that they support agricultural producers' or distributors' decisions by providing related information and consulting when they plan to produce or purchase before the production starts. A service model is required to derive necessary service features that support these missions. Therefore, the service model and related service requirements are proposed in this paper for the future standardization.

Keywords— Pre-production stage, Smart Farming

I. INTRODUCTION

The Smart Farming services at the pre-production stage are important in that they support agricultural producers' or distributors' decisions to avoid overproduction or shortage that may cause financial difficulties. These services provide related information and consulting when they plan to produce or purchase before the production starts.

In fact, there exist many difficulties to actualize such ICT convergence services in the agricultural field to cope with various obstacles such as weather changes, growth condition of farm products, and continual diseases or technical problems[1]. Moreover, the gap of viewpoints between the people engaged in farming and the IT engineers may cause more problems for accomplishing this mission. Hence, more efforts on standardization activities for more consensus are required.

The reference model for Smart Farming shown in the ITU-T Recommendation Y.2238[2] covers all the stages, i.e., pre-production, production, and post-production stages. At the pre-production stage, it is required to plan when and how to start the production process by providing necessary information or consultation. Furthermore, it is needed to standardize the service model for such ICT services to form a consensus between IT engineers and those who are related with Smart Farming[3].

The standardization process related with this issue has been in progress in ITU-Y SG13 and SG20 covering the service concept, service requirements, possible use cases and network capabilities for production and post-production stages[4][5], though the standardization for the pre-production stage is not initiated yet.

This paper proposes a service model showing the Smart Farming service at the pre-production stage for the standardization in ITU-T. Agricultural producers or distributors could attain the necessary information or consultation from service providers on the network infrastructure provided by network providers in the proposed model at the pre-production stage of Smart Farming.

II. SMART FARMING SERVICE AT THE PRE-PRODUCTION STAGE

The reference model shown in Y.2238 covers all the stages, pre-production, production, and post-production stages. Agricultural producers or distributors could attain relevant information or consultation from service providers on the network infrastructure provided by network providers as shown in the Figure 1.

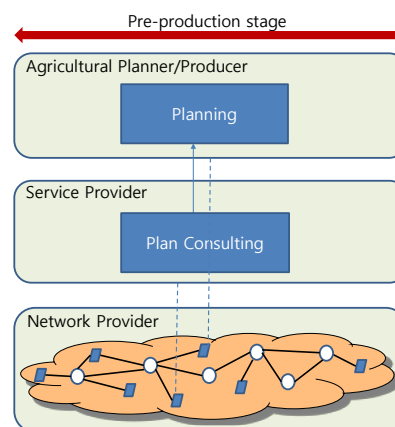


Figure 1. Relations for providing information or consultation at the pre-production stage

For more profits after the agricultural production, agricultural producers must be hard-edged as much as possible at the pre-production stage. Accordingly, the importance of plan consulting at this stage cannot be overvalued on this perspective. Plan consulting could be provided based on the big data analysis after collecting necessary information via

monitoring, data accumulation, and knowhow base management as shown in the Figure 2. These components need to be treated as parts or main ingredients of service features in Smart Farming at the pre-production stage. The next clause will describe the reference model for Smart Farming service at the pre-production stage considering these components.

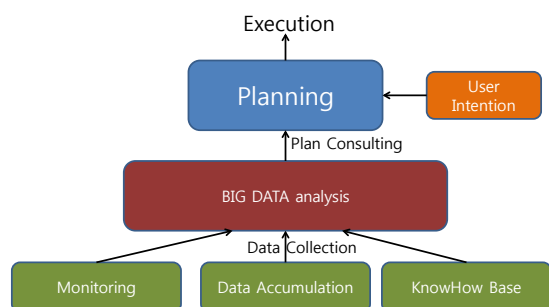


Figure 2. Required service components for planning at the pre-production stage

III. PROPOSED SERVICE MODEL FOR SMART FARMING SERVICES AT THE PRE-PRODUCTION STAGE

Considering the service components in the previous chapter, the service functions could be defined as shown in the Figure 3.

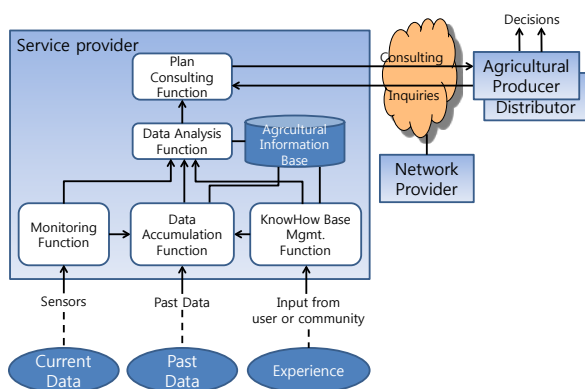


Figure 3. Proposed service model for the Smart Farming service at the pre-production stage

Monitoring Function gathers the current environmental data from various sensors measuring temperature, humidity, pH, etc. Current environmental data may include cultivation resource information such as available agricultural machines,

labor force, etc. Data Accumulation Function gathers all related information such as the past cultivation records, final profits per varieties of crops, etc. Knowhow base management function gathers experience-based information from users or user communities. These information from sensors, users or user communities can be conveyed through the telecommunication infrastructures provided by network providers. All these gathered information are transferred to Data Analysis Function which analyzes the gathered information and produces meaningful results that will help the consultation process. The analyzed results are transferred to Plan Consulting Function that interacts with the service users, Agricultural Producer or Distributor, to help the users to make decisions. More detailed descriptions about these functions are listed as follows:

A. Monitoring Function

This function gathers all data from circumjacent sensors, to measure temperature, humidity, illuminance, pH, etc., to capture the current status around the agricultural fields. The gathered sensor data are transferred to Data Analysis Function for raw data analysis and Data Accumulation Function for accumulation of history data.

B. Data Accumulation Function

This function manipulates the past data, current data from Monitoring Function, and experience-based data from KnowHow Base Management Function, then generates meaningful information to be transferred to Data Analysis Function as a guidance for data analysis or to Agricultural Information Base for service maintaining. Type of data to be accumulated are classified as follows:

1) Current Data: Data showing the current status around the agricultural area, mainly collected from sensors such as to measure temperature, humidity, illuminance, pH, etc. These data are mainly collected by Monitoring Function.

2) Past Data: Data showing the past history of the farming results such as past cultivation records, final profits per varieties of crops, etc. Such data can be stored to or retrieved from Agricultural Information Base.

3) Experience-based Data: Data from users or user communities such as the appropriate time for seeding, weeding, harvesting, or moderate amount of agricultural pesticides for each crop or plants, etc. SNS can be a good tool for collecting such data.

C. Knowhow Base Management Function

This function manages knowhow-based information from users or user communities such as the appropriate time for seeding, weeding, harvesting, or moderate amount of agricultural pesticides for each crop or plants, etc.

D. Data Analysis Function

This function analyses current data from Monitoring Function, past data from Data Accumulation Function, and experience-based data from KnowHow Base Management

Function. Data analysis in this function can be performed with the aid of Big Data analysis technologies.

Analysed results are transferred to Plan Consulting Function for response to the inquiries from service users such as agricultural producers or distributors, and also to Agricultural Information Base for future uses.

E. Plan Consulting Function

This function performs consultation in response to the service users' inquiries to help their decisions. Consulting in this function can be performed with the support of artificial intelligence technologies such as Deep Learning or voice recognition and synthesis technologies. Information for inquiries and consultation can be conveyed through the telecommunication infrastructure provided by network providers.

IV. CONCLUSIONS

A service model for Smart Farming services at the pre-production stage is proposed and described in this paper. The proposed service model will be applied to the standardization of a new draft Recommendation for defining the Smart Farming service at the pre-production stage in the next ITU-T meetings. More details such as service requirements and service scenarios need to be explored for this standardization. These standardization activities are expected to contribute to the global usages of Smart Farming technologies with more profits, productivities and efficiencies.

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Soong-Hee Lee received the B.S., M.S., and Ph.D. degrees from Kyungpook National University, Korea in 1987, 1990 and 1995, respectively. From 1987 to 1997, he was a member of research staff in Electronics and Telecommunications Research Institute. Since 1997, he has been with the department of information and communications engineering, Inje University. His research activities are in the area of next generation network technologies and services. He was designated as an IT Standard Expert on behalf of Korea by Ministry of Information and Communications in 2001. He is an Editor in the ITU-T SG13.



Dong-Il Kim received the B.S., M.S., and Ph.D. degree in electronics information and communication engineering from Kwang-woon University, Korea, in 1981, 1983 and 1992, respectively. Since 1991, he has been at Dong-Eui University, Korea, where he is a professor at the information and communication engineering department. From 1983 to 1991, he was a general manager at switching research center in LG information and communication institute. He was a visiting researcher at standardization research center, ETRI from 1998 to 1999. He was designated as an IT Standard Expert on behalf of Korea by the KCC in 2002. He is an Editor in the ITU-T. His research interests are analysis of performance in a communication networks, protocols in wireless networks and standardization of ICT.



Sok-Pal Cho received a Ph.D.(1992) from the Kyung Hee University, Seoul Korea. He was a computer system engineer at Control Data Corp. since 1976. He was a senior researcher at R&D Center, Sam Sung Co., from April 1984 to February, 1994. He was an assistant professor in the Division of Information and Data Communication at Nam Seoul University, Korea in 1994. He joined the department of Computer Communication Engineering, the Sungkyul University, Korea since 1995. Currently he is a professor of Telecommunication engineering and a vice president, Sungkyul University, Korea. He contributed 30 contributions regarding Y.iras (IT Risk Analysis Service) and Y.ctmp (Convergence Terminal in multiple network and application service provider environment) to ITU-T. He has published 56 papers and presented 13 documents on SIEC International Conference. He is a senior member of IEEE since 1995, a life member and vice president (1997~2007) of KIISC(Korea Institute of Information Security & Cryptology) since 1997, His interests are Network Security, Network Protocol, ATM and MPLS switching, E-learning, Next Generation Network, Future Network, and IT Risk.



Heechang Chung received the B.S degree from Korea University, Korea in 1980, M.S and P.H degree from Aju University, Korea in 1989 and 1997. He was a principal researcher at ISDN Center, ETRI from April 1980 to November 2000. He was a principal researcher at National Research Network Center, NIA from November 2000 to June 2014. Currently he is a professor of Telecommunication engineering, Donggeui University, Korea. His current research interests include future service management, service creation and standardization in ITU-T SG13.