Implementation of Mobile Application about Poly Context USN Data Mining and Display

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Abstract

Based on Smart Phone, this study added and implemented the mobile App to the existing IT agriculture system, which system automatically controlled green house's growth environment. The mobile App was developed by referring to the guideline to establish the mobile e-government service for 'Ministry of Public Administration And Security' in Korea, based on which environment the study developed the hybrid-App by referring to advanced technologies and how to design them related to the mobile App development. Because the mobile App characterfully possesses high portability, limited resource, mobile wireless network support, enterprise mobile computing support, etc., the hybrid-App should be inevitably adopted. The hybrid App can minimize resource consumption for performing related duties and also, in spite of the mobile device's limits, it can derive high performance, in which facts the system can ensure the service-based architecture's reliance and also, implements the highly sophisticated functionality as well. Through the proposed system, the study expects to contribute to improve quality of life as well as to increase farmer's income through IT-based agriculture system development..

Keywords: *Smart Phone, IT-based agriculture, Smart agriculture, U-agriculture*

1. Introduction

Since when Smart Phone was commercialized and distributed in 2009, according to the survey data from Korea Communications Commission and Korea Internet Security Agency from Nov. 21st to 30th, 2010, in the aspect of users' wireless devices, 92.5% out of them had used wireless Internet through Smart phone, in which they had used the Internet for 58.2 minutes in daily average. In connected with the Internet, mainly, users had used 3G-based communication network by 60.3%, in which they had used the mobile communication network by 45.3% and Wi-Fi by 45.2% in the aspect of how to access the Internet under individual preference [1]. 69.5% out of Smart Phone users installed 28 mobile Apps in average, in which 3 out of 10 chargeable mobile App down-loaders spent KWR 5,000 and higher in monthly average, based on which status they may commonly used the mobile App and also, under which trend all Internet services are expected to be modified and provided to App when the computing market moves from PC to Smart phone [2].

So far, authors have studied greenhouse environmental control based on USN [3, 4]. In addition, authors have progressed studies on USN-based green house's environmental control together with many other researchers [5, 6, 7]. Through the smart precision agriculture based on USN, so far, authors have promoted to study related fields under the concept that corresponded businesses and programs would be unconditionally needed for high quality and high income. According to Smart phone's popularity and distribution, however, each request on developing and distributing

mobile App occurs additionally. Therefore, authors intended to propose mobile App for the green house's environmental control system based on existing USN. On that point to propose Smart phone-based mobile App, authors proposed the standard system based on how to establish mobile e-government for Korean government as well as according to guideline, here, including most recent research performance.

2. Related Studies

2.1 Green House's Environmental Control

Recently, in Korea, each university and each R&D center has progressed studies such as green house management system implementation, remote monitoring system construction for the web-based green house, ubiquitous plants factory monitoring system's test bed construction, here, both of artificial light and sensor network were used, hog barn's integrated management system implementation under ubiquitous agricultural environment, agricultural environment monitoring system development by using integrated sensor module, etc [5, 6, 7, 8].

2.2 Author's UIT related study

The author has continued studying green house's environmental control, based on experience collected from existing research result and on-site experience and also, achieved some research results [3, 4].

The system, which was researched and developed by the author, consists of the environmental controlling client system to collect USN data, including farmer's directly controlling environment, the server system to collect data delivered by many farmers in order to use consulting data, and 3G communication-based data collection system to collect and gather data on both of 3G network and wire data network, etc. Author's real system was directly installed on farmer side, which system is used for real-time farming as well as basic data. Figure 1 depicts internal growth environment facilities such as temperature, humidity, etc. through sensors, various controllers, and server system. The system transmits green house's real-time information to the server through wire/wireless network.

2.3 Studies on Smart Phone App

Authors used to propose sightseeing information system through Smart Phone App [9]. Recently, according to studies on App development standard, various tries to implement much more efficient App have been increasingly challenged. First, Korea government distributed guidelines such as the mobile e-government service management guide [10], the mobile service construction guideline for the public [11], administrative tasks based on mobile service construction guideline [12], e-government service user interface design guideline [13], etc. According to Smart phone's generalization, there have been various trials for developing Smart Phone App, which efforts have been made for architecture pattern and application guideline to design highly sophisticated mobile applications [14], real-time cargo tracking and intelligence transportation/delivery management system by using Smart phone [15], Smart Phone App design and implementation to provide SCAMPER technique [16], mobile App using status and strategy for activating Smart phone [17], etc. This study referred to 'architecture pattern and application guideline to design highly sophisticated mobile applications' as the main data.

3. Smart Phone Mobile Monitoring Application Development

3.1 Summary on the Whole Duties

Multi-variable environmental control system for green house makes information collected from various sensors and operated equipment for green house interlinked, in which real-time control values are stored. The system controls ventilation, heating equipment, boiler, CO2 concentration, nutrient fluid controller, etc., based on and supported by information from various growth sensors and environment sensors inside and outside greenhouse[4]. The Smart growth environment management server system constructs the data logging server for sensing information DB received from each farmer's terminal proxy servers and also, establishes user interface for web-based monitoring. In addition, the system provides various sensing information collected from the green house's insides and outsides as well as various statistical predicted information.

3.2 Mobile App Design

3.2.1 Concept Extraction: Pre-developed Smart phone's App had been developed by reflecting duty planning in the most cases. Therefore, architecture had been naturally omitted so far. In future, because issues on Smart Phone may keep occurring, at this phase, the architecture definition can be said to be clearly prepared. At this phase, as mainly referred data, 'architecture pattern and application guideline to design highly sophisticated mobile applications' was the most helpful in the conceptual aspect. The above thesis' authors defined portability, resource's limits, mobile wireless network support, enterprise mobile computing support, etc., which concepts are about mobile device's characteristics. Also, based on such facts, they proposed client and server architecture pattern, balanced MVC architecture pattern, service-based architecture pattern, and hybrid architecture pattern. This study mainly adopted the hybrid architecture to fully accommodate strengths and weaknesses on client and server architecture pattern, balanced MVC architecture pattern, and service-based architecture pattern. Also, because the study aimed to serve public authorities, UX design of mobile service for public authorities are reflected as basic principles. The hybrid App to serve public authorities thinks much of users' experience and device's scalability and information alienation class' accessibility, in which phase it observes W3C standard to separate and develop HTML/CSS/Java script and optimize table layout for each device.

Mobile data interconnection conceptually comes to limit the mobile service construction guideline for the public to representative three items as follows: web service type, EDI type, Display Link type. At this phase, service providers should develop the service related program and then, register it to UDDI (Universal Description Discovery and Integration) as well. Table 1. Shows Mobile standard framework's user experience[8].

Table 1. Mobile Standard Framework's User Experience

Service	Function explanation
Visual Experience	Panel, Label/Text, TABS, Form, Grid, Table/List View, Icon
Interface Experience	Button, Menu, Dialog, Date/Time Picker, Check/Radio, Selector/Switches
Effect Experience	Internal/External Link, Processing Dialog/Bar

3.2.2 Hybrid App Architecture Design: Based on concepts arranged by advanced studies, the study selected the hybrid App and found out UI through mobile e-government service construction guideline. Fig 1 was designed under such above concepts. The study fully prepared for the device's menu such as View, Control, and Modeling Architecture and also, it furnished architecture for server control layer and server model layer on the server side. Data's mutual exchanges should observe W3C mobile web standard and also, the data transmission standard based on XML was observed and developed. SREMS (Smart Raising Environment Management System) receives growth environment information from farmer's green house in order to display the results transmitted from the mobile device and at this phase, it can edit environment setup. Model layer defines the instruction on how to display data transmitted from the server. The server system uses existing system developed already through advanced researches as it is. In addition, UDDI architecture is defined to exchange data between servers and clients.

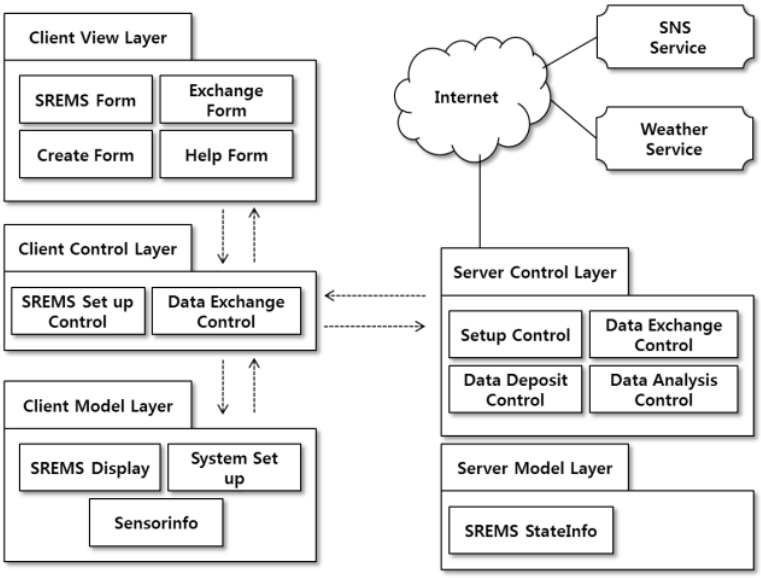

Figure 1. Hybrid App Architecture Design

3.2.3 UI Design: The mobile service user's interface design guideline reflects each user's experience such as target users for establishing the mobile service, using environment, using objects, etc., in which the study proposes following model and also, the proposed model recommends that user interface was designed. As for the header area for the public service, site name/logo or belonging agent name are exposed, which may show off identity as public service and also, as for Footer area, in the case that PC version would be served, the fact recommends that each link is provided for each PC version. In addition, when the same contents are displayed on both of PC screen and mobile screen, it recommends that comparatively large letters and plain contents are displayed because the mobile device's user understanding degree comes to be significantly lowered than PC version.

3.3 System Implementation

Existing built smart growth environment management system is developed by using Linux, Tomcat 5.X, Oracle DBMS, including Eclipse, Java as development tools. Based on existing pre-work, the system develops xcode 4, ObjectC, supported by iOS 4.X as iPhone-based

application and at this phase, UI used HTML5. In the system, the important element is a part to receive data on existing servers through communication network, in which the linked program will be developed according to WSDL (Web Service Description Language) from UDDI. At this time, data will be received in XML format. The App's serviceable task is to monitor green house's growth environment control status in real-time, to set up control values, and to display analyzed data. The environment setup information, the status display, and analysis information screen display are implemented in the existing web interface as they are.

Figure 2. Mobile App User Interface

As for the system's characteristics, some functions are run on servers and data is provided by related services. Therefore, function's complexity metric, which is run on the mobile device, is low. Therefore, the system guarantees quick response. The study implemented the system as follows. On main screen, Setup, Monitoring, and Analysis menus can be selected and also, on the server screen, the property information can be selectively displayed. The system screen is implemented as it is, supported by web system's display screen and also, the detailed information can be shown through zooming-in and out functions. In the below, SREMS user interface already developed is shown off. Fig 2 shows SREMS Mobile UI.

The setup menu can control and set up synchronization status, amount of solar radiation, temperature, humidity, window, curtain, heater, etc. and the monitoring function can monitor growth environment information such as green house's inside temperature, humidity, etc., sunset and sunrise information, external environment information, etc. Also, the system can provide linear regression analysis, multi-statistical analysis, DIF analysis, etc. Table 2 arranges for SREMS function list in a table format.

Table 2. SREMS Function Definitions

Menu	Display
Setting	Amount of solar radiation control, wind control, control device control, date to control and synchronize humidity, operation time, standby time, and heating temperature.
Monitoring	Growth environment information, sunset and sunrise information, and external environment information
Analysis	linear regression analysis, multi-statistical analysis, and DIF analysis

Through SREMS development, existing green house management duties have kept being free from space. Existing green house's internal control, which used to depend on farmer's decision, has been developed in automatic control type, supported by various sensors and monitoring and control duties, which facts used to be achieved within only wired Internet space, have been extended to all spaces through Smart phone. Also, besides farmers, as for agricultural consultant's duties, consultants don't have to visit work-site to deliver their advices to farmers any more.

3.4 System Assessment

The mobile device's characteristics are high portability, limited resource, wireless network, condition recognition function, enterprise mobile computing support, etc. Because of such functions, the mobile device requests minimized resource consumption, optimized performance, portability related reliance, and highly sophisticated functionality.

Authors adopted the hybrid App to develop SREMS. As for the hybrid architecture pattern, its function is operated on servers or service provider's servers. Therefore, its function can be performed at other spaces without the mobile device and also, because its highly sophisticated function is run on external server and some functions can be provided by related services, its functions, which are performed on the mobile device, may have low complexity. Because of such facts, the mobile device just treats lowly sophisticated functions. Therefore, mainly, quick response can be guaranteed, also, some functions can be performed by given services, and highly sophisticated functions can be run on server side having plentiful computing power. Such quick response can be guaranteed, anyway. At this phase, the hybrid architecture has partially combined configuration between balanced MVC and service-based architecture pattern. In accordance as the amount of tasks, which cannot be treated by the mobile device, can be committed to servers, the mobile device's scalability can be guaranteed.

The hybrid architecture pattern installs specific server's functions for the mobile application. Therefore, because it adopts the technique to guarantee servers' reliance in order to design its architecture, service-based architecture's reliance can be ensured.

4. Conclusion

Authors developed SREMS, based on 'Smart growth environment management system' through their advanced studies. Now, authors can remotely monitor and control green house through the Internet and also, both of system monitoring and controlling can be performed by using Smart phone, anywhere. Because of such facts, agricultural technologies can be implemented without limits in aspects of spaces and time, which is expected to significantly contribute to farmer's income increase as well as farmer's quality of life because agriculture never minds time and space limits, now.

The system implemented and designed the hybrid App to satisfy minimized mobile device resource, optimized performance, portability and related reliance, highly sophisticated functionality, etc. The hybrid App is the mobile system which combines and includes client-server architecture, balanced MVC architecture, server-based architecture, which system can provide us with high performance and highly sophisticated functionality, and portability and related reliance. Based on this study, Smart Phone App having much higher performance will be studied and developed in future. Hybrid App will be developed as much more stable system with it developed and extended around all systems under the mobile services as well as SREMS.

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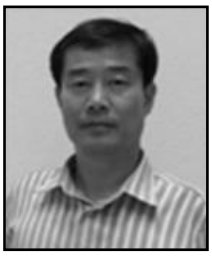

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