

A Study on Agricultural Machine Sharing Application

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Abstract

The government has set the mechanization of paddy agriculture as a national task, aiming to achieve over 70% by 2025. The main objective is to stabilize the farming costs of rural households due to the aging and feminization of rural areas, as well as the shortage of agricultural labor. In response to this, the Korea Rural Economic Institute operates a farm machinery rental business. However, there are challenges in selecting and managing rental machinery, including issues related to labor, costs, verification, and time. Additionally, there is a limit to upgrades, and overseas models are being imported and used for transplanters and rice planters, which do not conform to domestic standards and face maintenance difficulties. In order to solve the difficulties of the agricultural machine rental business, we intend to develop an application that shares domestic and foreign machines purchased and used by individuals at a low cost and use them in gun-level administrative districts.

Keywords: Top-k, Application, Agriculture Machine, Java, Android

1. INTRODUCTION

The government aims to achieve a paddy agriculture mechanization rate of 77.5% by 2026. However, due to the aging rural population and a decrease in the workforce, there is a growing need for mechanization in agriculture. Despite this, the mechanization rate for paddy agriculture, which requires the most manual labor, remains below 60%. According to data from the Rural Development Administration for the period 2012-2022, the mechanization rate for upland farming is 97.7%, while that for paddy agriculture is only 59.3%. Although the Korea Rural Economic Institute operates farm machinery rental businesses in various regions, there are limitations in the development of farm machinery, upgrades to existing models, and the utilization of imported overseas models for transplanters and rice planters, which has led to a high cost of operation. Some farmers also find it difficult to rent machinery because of concentrated rental during specific farming periods. Therefore, this study proposes the development of an application for sharing farm machinery used by farmers to address these challenges. Therefore, this study proposes the development of an application for sharing farm machinery used by farmers to address these challenges [1].

2. RELATED WORKS

According to the "Evaluation and Consulting on Farm Machinery Rental Business 2021" by the Korea

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Rural Economic Institute, there is a need for the development of transplanters and rice planters suitable for domestic agricultural conditions and the promotion of pilot projects. This includes addressing the challenges of high development costs and extended development periods for farm machinery, as well as distribution and sales difficulties after development[2]

Table1. Development of new type of agricultural machinery rental business and discovery of new business[2]

Research and Development of Agricultural Machinery Rental Business	Promotion and improved utilization of transplanters and planters
<p>Limitations in research and development of field-specific agricultural machinery by manufacturers</p> <ul style="list-style-type: none"> - Long-term increase in development costs and duration for agricultural machinery - Difficulties in distribution and sales after the development of agricultural machinery - Requirements for test testing, demonstrations, and evaluation procedures 	<p>Issues with transplanters and planters</p> <ul style="list-style-type: none"> - High distribution rate of seeders for field agriculture through domestic development or import of foreign models - Challenges in the direct field application of transplanters and planters due to domestic and foreign products not matching local conditions, excessive purchase costs, the need to buy specialized seedling trays, and seedling management
<p>Limitations in upgrading the model types of distributed agricultural machinery</p> <ul style="list-style-type: none"> - Strengthening the verification and registration system for agricultural machinery by the Practical Use Foundation for Agriculture - Excessive costs and prolonged periods for machinery verification 	<p>Solutions</p> <ul style="list-style-type: none"> - Developing transplanters and planters suitable for domestic farming operations and initiating pilot projects

As shown in table1, there is also a need to strengthen the verification and registration system for farm machinery and address the high verification costs and lengthy verification process. The widespread adoption and utilization of transplanters and rice planters face challenges due to differences in domestic and foreign production, high purchase costs, the need for specialized boards, and difficulties in on-site application. To address these issues, the study proposes the development of an application that allows individuals to share the farm machinery they have purchased for use by others in their region, in exchange for a cost-sharing arrangement. The study focuses on the administrative areas at the county level for operating the app [2]

3. APPLICATION DESIGN AND IMPLEMENTATION

In this section, the design and components of the farm machinery sharing application are described, including the system configuration and the roles of providers and clients. The system configuration diagram is introduced in subsection 3.1, while subsection 3.2 explains the design and implementation of the farm machinery sharing application.

3.1 Structure for application design

In this section, the system configuration diagram for the farm machinery sharing application is introduced. Figure 1 illustrates how providers of farm machinery upload their idle machinery to the farm machinery sharing server during their idle periods. Clients who wish to use farm machinery select the desired machinery from the list of available machinery and request rentals for specific dates. Farmers within the same county can search for shared farm machinery and pay 10,000 KRW per day for usage, with providers receiving monthly settlements.

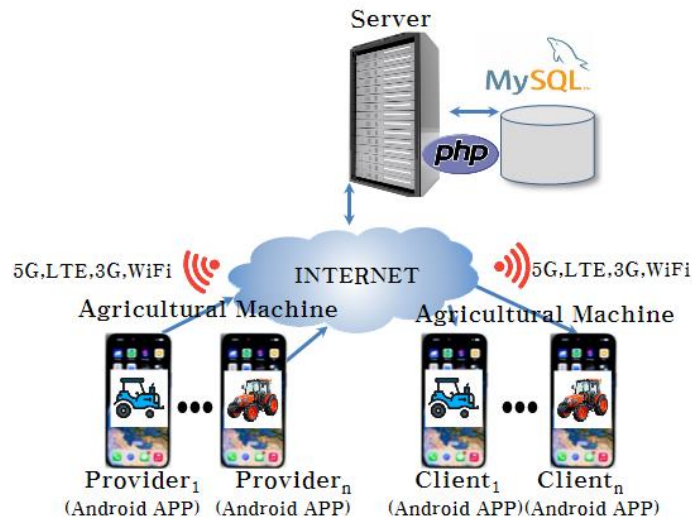


Figure 1. System Architecture

3.2 Consideration for application design

The farm machinery sharing application is designed to be convenient for anyone in the county to share idle farm machinery, register their machinery during idle periods, and request rentals for needed machinery.

- 1) Provider: Providers are individuals who register their farm machinery for sharing during idle periods and charge a rental fee of 10,000 KRW per day. Settlements are made every three months to their designated bank accounts.
- 2) Client: Clients select and apply for farm machinery from the registered list for specific dates and pay a rental fee of 10,000 KRW. The application also includes a feature that recommends machinery based on the client's currently cultivated crops, with recommendations determined using a Top-k algorithm.

4. APPLICATION IMPLEMENTATION

In this chapter, the design and implementation of the proposed farm machinery sharing application are presented. The actual system is implemented using a JAVA (Android) app with MySQL. Section 4.1 describes the registration process for all users of the app, including registration of information about the crops currently being cultivated. Section 4.2 introduces the menu for providers of farm machinery to register their idle machinery and request rentals. Section 4.3 explains how the app recommends farm machinery based on the crops currently being cultivated [3, 4].

4.1 User registration

The farm machinery sharing application operates at the county level, where users in adjacent regions share idle farm machinery. Therefore, user registration requires verification of the user's county, and users can register information about the crops they are currently cultivating to receive recommendations for machinery needed at the current time.

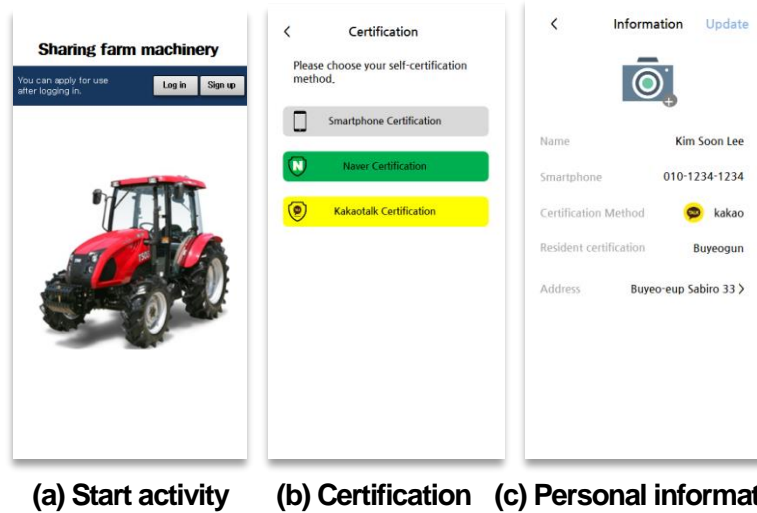
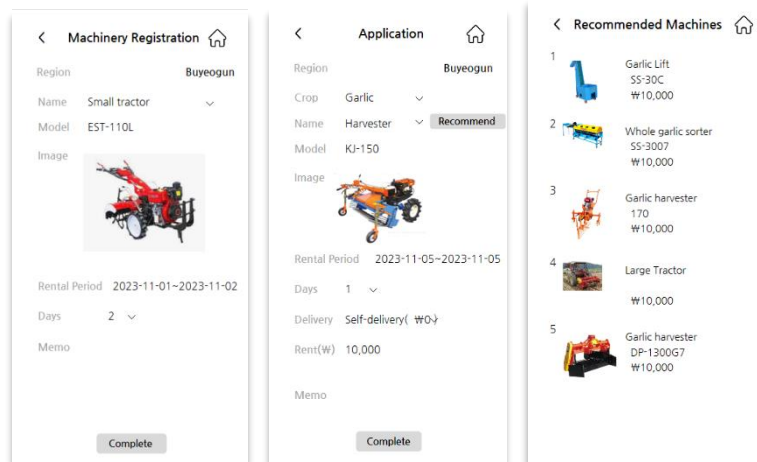


Figure 2. User Registration Activity

Figure 2 is the user registration screen, Figure 2(a) is start activity, Figure 2(b) is certification activity, and Figure 2(c) is personal information activity [5, 6]

4.2 Registration and Rental of Farm Machinery



(a)Agricultural machinery registration (b)An application for lease (c)Machine recommendation

Figure 3. Registration and Rental Activity

Through the menu for providing farm machinery, users can register their idle farm machinery and specify their rental fees. Users can also update their bank account information for receiving settlements. Rental requests can be made by selecting the desired machinery and dates, with a rental fee of 10,000 KRW.

Figure 3(a) is a screen for registering agricultural machinery and shows the state in which the rental account name, photo, rental period, and rental days are stored. Figure 3(b) is a screen for leasing agricultural machinery and shows that the information on agricultural machinery to be applied, application period, delivery status, and rental cost are recorded. Figure 3(c) is a recommended machine screen and recommends the machines needed for the crops being grown. For this crop, the five most used agricultural machines within 30 days are recommended.

4.3. Recommended Farm Machinery

The list of recommended agricultural machinery provides a recommended list of 5 frequently used machines that are required for the current crops currently cultivated using the Top-k method. Figure 4 shows an algorithm that recommends agricultural machinery and the five most used machines in the last 30 days that are suitable for current crops.

Algorithm: Agriculture machine Recommendation

Input. n_m_count: Number of agricultural machines used

Date: When the user is using it.

Output. Show the 5 most used machines in the last 30days.

Algorithm:

- 1: //Get today's Date.
 - 2: SELEC Mycrop list for 30days from today.
 - 3: COUNT Those machine list
 - GROUP BY p_code
 - ORDER BY desc.
 - 4: //Show selected the most 5 used machine
 - ORDER BY COUNT in 30days From today.
-

Figure 4. Agriculture Machine Recommendation Algorithm

5. CONCLUSIONS

In conclusion, this study addresses the labor shortage issue in rural areas due to the aging population and population decline, which has led to an increasing need for mechanization in agriculture. However, the mechanization rate for paddy agriculture remains below 60%. While research and development efforts need to be strengthened to increase this rate, the budget for 2024 has been cut by nearly 20%. Although farm machinery sharing rental businesses operate in various regions, challenges in selecting and managing rental machinery, along with issues related to labor, costs, verification, time, and upgrade limitations, have been observed. To address these challenges, this study has conducted research and implemented a farm machinery sharing application. The application allows farmers to share idle farm machinery during their unused periods,

enabling cost-effective machinery sharing. Further research is needed to address any issues that may arise from the use of the farm machinery app in practice.

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