

# Design of Mobile Scheduling Platform for Wine Grape Farm Machinery Equipment

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## Abstract

**At present, China is in the stage from agriculture 3.0 to agriculture 4.0. The demand of intelligent agricultural machinery dispatching platform combined with mobile terminal and Internet is extremely urgent. Therefore, based on the analysis of the operation of agricultural machinery in wine grape production area, this paper identifies and analyzes the problems in the research of wine grape agricultural machinery scheduling platform, and puts forward a design of wine grape agricultural machinery equipment mobile scheduling platform.**

## Keywords

**Internet of Things (IOT); Agricultural Machinery; Intelligent Scheduling Algorithm; Mobile Platform; Architecture Design.**

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## 1. Introduction

In recent 40 years, the wine industry in Helan Mountain Area of Ningxia has developed rapidly, which has led to the cultivation of wine grape. However, the production of wine grape is still relatively backward, which leads to the obvious shortage of wine production in China. Therefore, it is urgent to improve the production of wine grape in China. However, the long time, high intensity, low efficiency and high cost of wine grape operation have become a serious obstacle to the large-scale development of grape industry and the improvement of economic benefits. Coupled with the arid and semi-arid climate, complex and diverse terrain and other environmental factors in Ningxia, the current situation of wine grape planting in the eastern foot of Helan Mountain is very serious, and the research and development of wine grape agricultural machinery and equipment has laid a good material foundation for the large-scale development of grape industry. But with the growth of the number of agricultural machinery and equipment, the use efficiency of agricultural machinery and equipment is not high enough, which often leads to the idle of some agricultural machinery and equipment in the busy period of agriculture, and sometimes leads to the repeated waste of agricultural machinery and equipment scheduling between farmland, resulting in a lot of unnecessary waste of human, material and financial resources. In this context, a mobile terminal scheduling platform for wine grape agricultural machinery equipment is established to conveniently view the growth and development of grapes in the field through the mobile devices of Internet of things. Farmers can discover the demand of grapes for irrigation, weeding and other agricultural activities as soon as possible, so as to realize the real-time scheduling of agricultural machinery and equipment, to ensure the survival rate and yield of crops is the primary goal to increase the yield of wine grape, and it is also an effective support for the transformation of modern agriculture.

## 2. Organization of the Text

The Agricultural machinery and equipment mobile terminal scheduling platform is an important part of China's transformation from traditional agriculture to smart agriculture. Smart agriculture requires a comprehensive combination of information technology and agricultural production, and provide a

mobile scheduling platform for agricultural machinery and equipment to improve the efficiency of the whole system[1]. The construction of agricultural machinery equipment mobile terminal scheduling platform is closely related to farmers, agricultural machinery operators, government, agricultural machinery operation service institutions and other stakeholders. Relying on big data technology, agricultural machinery equipment mobile terminal scheduling platform can process and judge various types of data generated in the scheduling process of agricultural machinery equipment. Combined with computer and network technology and other software technology, and using scientific analysis methods and scheduling algorithm design, agricultural machinery operation, agricultural machinery equipment, agricultural materials, agricultural machinery operators and other information can be integrated and utilized[2]. To sum up, the mobile scheduling platform of agricultural machinery equipment can coordinate the scheduling of agricultural machinery equipment and real-time monitor the field operation tasks. It helps farmers better understand the status of agricultural machinery equipment and better communicate with agricultural machinery operators in the way of online mobile platform, broaden the channel for agricultural machinery operators to obtain field operation requests; It helps agricultural machinery operation service institutions to greatly save the management cost of agricultural machinery. Based on Internet plus, Internet of things, big data and other information technology is the main mode to promote the development of Intelligent Agriculture in China[3]. On the one hand, the application of agricultural equipment mobile terminal scheduling platform can improve the efficiency of resource allocation, agricultural equipment management, and save human, material and financial resources. On the other hand, it can enhance economic and social benefits, improve the ecological environment to a certain extent, and promote green development. Scholars and practical enterprises at home and abroad have carried out active research and exploration around the agricultural machinery and equipment scheduling platform. Foreign agricultural machinery management platform developed earlier, and the technology is relatively mature. Silsoe Institute (1994) developed a series of agricultural machinery management software in the paper Decision Support System for Mechanical harvesting and transportation of Sugarcane in Thailand. The platform integrates cost accounting, machine selection and matching, operation planning and other functions[4]. Sichonany O R D O, Schlosser J F et al. (2011) established a set of decision support platform in the Computer System Management of Agricultural Machinery Sensor Performance Monitoring, which can monitor agricultural machinery performance, real-time access, dynamic storage data and other features in real time, which can greatly help farm managers and operators to make operation decisions and improve operation efficiency[5]. Agricultural equipment informationization development in China started late, compared with foreign related theory research, we still have some gap, but in the domestic many scholars under the extensive research and discussion of information management system of agricultural machinery in our country have also made some achievements, especially in equipment management, can the status of agricultural machinery management and real-time positioning, for our country agricultural machinery equipment management provides the thinking and practice. In the design of cotton picker geographic location information service system based on Google Maps, Chen Mengna et al. (2013) developed a geographic location service platform for cotton picker by using Google Maps and combining GPS and database technology to carry out real-time positioning and path navigation of cotton picker[6]. In Design and Research of Agricultural Navigation and Positioning System Based on GPS/SINS Combination, Li Yongjian et al. (2014) proposed an integrated navigation algorithm based on GPS errors in agricultural machinery positioning, corrected GPS positioning data by SINS to improve positioning accuracy, and designed a navigation and positioning platform for agricultural vehicles[7]. After 2015, domestic scholars began to study smart agriculture and mobile agriculture, and a number of representative agricultural machinery management software such as agricultural machinery help, agricultural housekeeper, agricultural technology treasure, etc. appeared, these Internet agricultural software also promoted the development of domestic agricultural machinery equipment scheduling platform to a certain extent, but in the control of scheduling platform, such as intelligent scheduling and efficiency calculation There are few related studies.

To sum up, the current domestic and foreign research on the scheduling platform of agricultural machinery equipment is only based on the collection and storage of information, but ignores the intelligent scheduling, path optimization and other control aspects of the equipment. The research on the scheduling of wine grape agricultural machinery is only limited to the PC as the main control system platform architecture, and the human management is the main scheduling method, so there are some problems such as high technical requirements for operators, information asymmetry caused by scheduling information lag, and the research on agricultural machinery mobile terminal scheduling platform is only limited to greenhouse, the research on its operation in the field is still insufficient. The scheduling of wine grape in mobile terminal will improve the time and space efficiency of scheduling, and bring more convenient and fast experience for farmers. With the continuous updating and iteration of mobile phones, the R & D and application of mobile terminal platform will be the development trend of scheduling platform, and will also be an important carrier for the next step of the implementation of smart agriculture. Therefore, this paper designs a mobile scheduling platform for wine grape agricultural machinery equipment, and designs a mobile scheduling platform for field agricultural machinery equipment.

### 3. Literature References

The system combines the Internet of things with mobile terminal technology, aiming at the interactive relationship of information communication and operation between farmers and agricultural machinery operators in the process of agricultural machinery equipment scheduling, and it is based on the three-level architecture of "perception layer -- transmission layer -- processing layer" of Internet of things, the functions of mobile terminal scheduling platform of wine grape agricultural machinery equipment are further divided, mainly realizing the general flow of intelligent agricultural machinery equipment scheduling, which can collect field data, query the status of field, inquire the usage status of agricultural machinery equipment, rent agricultural machinery equipment, dispatch equipment to work, and evaluate after user use.

From the user registration account to the user login account, the user address and planting scale can be recorded. From adding equipment information to inputting basic information of equipment information, the basic function of classified management of equipment types is realized. The basic functions of concession agricultural machinery module and scheduling agricultural machinery module can be realized from the selection of leased agricultural machinery equipment and agricultural machinery operators to the final generated concession transaction records. Finally, the corresponding scheduling records can be obtained to realize the core purpose of building the platform. Through the platform, the rapid and comprehensive scheduling of agricultural machinery equipment can be realized, and the intelligent scheduling algorithm can be used to make the agricultural machinery fully utilized.

The design of wine grape agricultural equipment mobile scheduling platform is based on the functional architecture of agricultural equipment scheduling platform, which is mainly oriented to the scheduling platform design of agricultural mechanization operation service organization. Due to the different scheduling environment, scheduling requirements and agricultural machinery scheduling situation in different regions, the necessary functional design of the architecture design of agricultural equipment information scheduling platform is made. Taking the scheduling scenario within the agricultural park as the research content, the architecture design diagram of mobile scheduling platform for wine grape agricultural machinery equipment is designed, as shown in Figure 1.

1) Database layer: integrate different databases, including environmental information database, crop information database, park information database, hardware information database, standard parameter database and agricultural machinery information database. Provide the format specification of the database of the application system, and store different data through various databases.

2) Data access layer: including environmental information management, disaster information management, crop information management, growth cycle information management, regulation

information management, planting area management, hardware equipment management, agricultural manipulator information management, user information management, standard parameter information management, responsible for all kinds of information management.

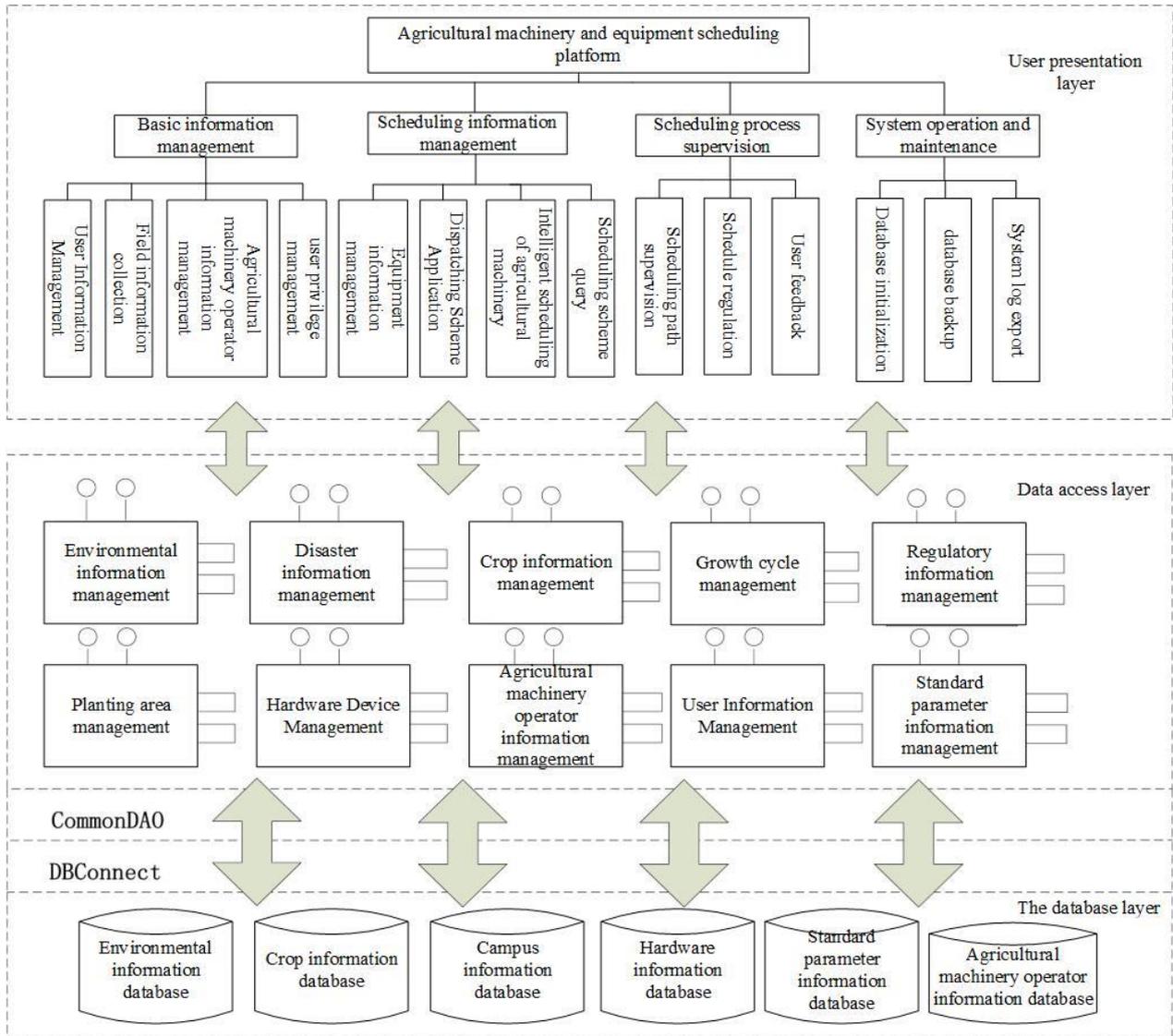


Figure 1. Platform Architecture Design Diagram

3) User representation layer: user representation layer is also called user interface layer, which mainly encapsulates all forms and components of human-machine interface, and is the direct interface between application system and system users[8]. It is mainly used to display the data information transmitted by the data access layer.

According to the guidance of the overall architecture diagram, the functional modules are divided into four modules: basic information management, scheduling information management, scheduling process supervision and system operation and maintenance.

1) Basic information management: mainly used for the collection and storage of basic information, including user information management, field information collection, agricultural manipulator information management, user authority management.

2) Scheduling information management: mainly used for scheduling information query, collection and storage, including equipment information management, scheduling scheme application, agricultural machinery intelligent scheduling, scheduling scheme query.

- 3) Scheduling process supervision: including scheduling path supervision, scheduling progress supervision, user evaluation feedback, which can realize the supervision of the scheduling process.
- 4) System operation and maintenance: mainly to maintain the database and generate system log, database initialization, database backup, report analysis, system log export.

The platform uses the Internet of things technology, uses terminal sensors to collect field operation information, and transmits data to the cloud platform through 4G network. After comparing with the information in the database, cloud computing determines the basic intelligent scheduling scheme, and then transmits it to the client scheduling platform and agricultural machinery equipment to realize the intelligent scheduling of equipment. The preliminary system architecture of this platform is shown in Figure 2.

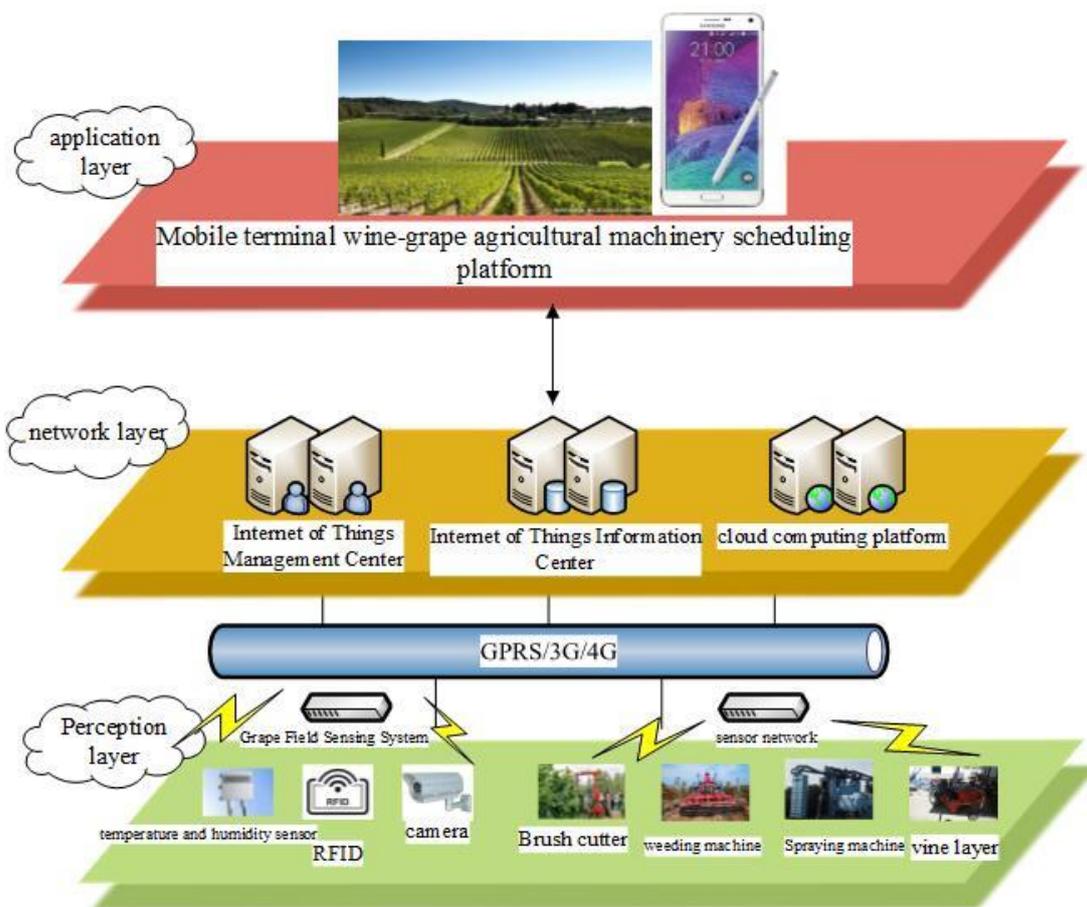


Figure 2. System architecture diagram

**Perception layer:** this layer uses the basic sensor equipment of the Internet of Things, such as temperature and humidity sensor, monitoring camera, etc., to monitor the growth of wine grapes in the field in real time, and then uses the sensor array of agricultural machinery equipment to collect the position and state information of the equipment. Through GPRS, 3G and 4G mobile networks, such information is transmitted to the cloud server at the network layer.

**Network layer:** This layer will receive the information collected by the awareness layer, collect and uniformly manage it on the server side. After the cloud computing platform selects the appropriate scheduling scheme, the platform uses genetic algorithm and round-robin search algorithm to solve the scheduling problem of agricultural machinery, constructs the scheduling model of wine-grape agricultural machinery and equipment, and plans the optimal path. The evaluation and supervision of agricultural machinery operation quality and capability through big data analysis can lay a foundation for further agricultural machinery and equipment scheduling. The platform uses the collected data to determine different priorities, determine the processing order of scheduling, and call up the remaining

amount of agricultural machinery and equipment from the cloud database, so as to schedule appropriate equipment according to the distance, machine state, etc.

Application layer: this layer is responsible for classifying the scheduling information to the mobile terminal wine grape scheduling platform. The general plan of dispatching, type of agricultural machinery and equipment, operation of agricultural machinery and the current operation situation will be passed to User Port where the farmer is. The location and specific scheduling plan of agricultural machinery and equipment will be transmitted to the client where the agricultural machinery operator is located. At the same time, a dialog window is established to ensure the real-time communication between the two parties. At the end of a production job, the evaluation and feedback functions will provide lessons learned for the next dispatch.

#### **4. Application prospect of mobile scheduling platform for wine grape agricultural machinery equipment**

As a large agricultural country, China is in the stage of modern agriculture from agriculture 3.0 to agriculture 4.0. The agricultural industry has a bright future. Wine, as one of the characteristic industries in China, plays a great role in China's economic development. As an important raw material of wine, the yield and quality of wine grape are very important. As the top priority of accelerating the construction of agricultural informatization, the mobile scheduling platform of wine grape agricultural machinery equipment plays an irreplaceable important role, which can simplify the farmers' scheduling request for wine grape agricultural machinery equipment, enhance the communication between farmers and agricultural machinery operators, and greatly increase the use efficiency of wine grape agricultural machinery. It can increase the yield of wine grape and the quality of production operation, in order to achieve the purpose of improving the yield and value of wine.

The research and development of mobile scheduling platform for wine grape agricultural machinery equipment will provide a new idea for the combination of scheduling platform and mobile terminal, which can make the allocation of equipment more reasonable and the related work of wine grape more efficient, and fully solve the problem of information management of wine grape agricultural machinery equipment. Compared with PC terminal, mobile terminal has incomparable advantages because it is easy to carry, easy to operate, easy to share and so on, which is conducive to the use of farmers with low education level. The mobile scheduling platform of wine grape agricultural machinery equipment will provide experience for the future agricultural machinery scheduling platform, and help to implement agricultural informatization and intelligent construction.

#### **5. Conclusion**

The design of mobile scheduling platform for wine grape agricultural machinery equipment based on Internet of things is to improve the production and value of wine grape, meet the needs of farmers for wine grape agricultural machinery equipment scheduling, solve the growing demand for wine grape in China, and further improve the quality and yield of wine in China.

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