Design and Implementation of Patrol and Attendance System for Forest Ranger

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ABSTRACT

Aiming at the problem of the forest rangers’ inefficient and nonstandard patrol attendance and urgent problems cannot be solved in time, a patrol and attendance system is designed and implemented to carry on user, attendance and communication management. The system takes advantage of MySQL database, PHP language, as well as the ArcGIS API, AJAX, WebSocket and other technologies. Practice indicates that the system can not only make the administrators’ management effectively, but also can solve the urgent incidents through real-time monitoring and communicating in time.

Key words: Forest Ranger; ArcGIS; Patrol and Attendance; Real-time Monitor and Communication

INTRODUCTION

Ranger shoulders the responsibility of protecting forests, reporting the fire and urgent case. The rangers’ management is an important working content of key national public welfare forest, local public welfare forest, natural forestry resources protection and the necessary foundation of modernization of forestry management and maintenance of ecological security. In order to strengthen the rangers’ management, improve the rangers' sense of responsibility, give full play to the role of forestry frontier supervision, protect forest resources at the same time to feedback timely about forest fires, pests, deforestation and other events, so there is a need to manage rangers strictly. However, there are many problems in the
traditional patrol work such as information and reports issued not in time, hot spot locations are not accurate, staff scheduling is unscientific even job performance is difficult to confirm due to the ranger free properties of fieldwork. Then to confirm work efficient and solve the problems of high investment and low returns, we must combine with the GIS to make the management work informational, technical and scientific [1].

Therefore, the paper is based on the need of patrol and attendance system, uses MySQL database, PHP language, as well as the ArcGIS API, AJAX, WebSocket and other technologies, design and implement a ranger patrol and attendance system with user, attendance and communication management functions. The system uses ArcGIS as a base map, in the base map to draw patrol track, the current position, patrol area and other information. And using the information to summarize the status of each ranger's attendance so as to managers can understand the ranger daily status conveniently and intuitively and manage efficiently.

SYSTEM ANALYSIS AND DESIGN

System Objectives

The design goals of system is using real-time comprehensive information collection technology and scientific management techniques to optimize ranger and administrator dual aspects of the work without changing the existing management system of forestry and the existing staffing conditions. The rangers’ post properties is special. First, it’s important to send and receive information, patrol and protect the blind area the same to personal security in the process of its field operations. Second, due to the high degree of the work, the motivation, conscientiousness and responsibility of the ranger would be easy to change once management absence. For manager, they need a set of complete and scientific management platform to designate area of the rangers, dispatch officer and check attendance. Therefore, the system should meet the following requirements.

(1) Mastering rangers real-time working condition by intelligent positioning equipment(such as Beidou terminal and smartphone). Solving problems include inconvenient sign in, not real-time work status, complicated attendance management.

(2) Collecting rangers’ information every 5 seconds and confirm they specific location to ensure the rangers own safety and the accuracy of information provided.

(3) The system could track the rangers’ real-time location and playback history so as to have evidence to performance appraisal.

(4) Forest protection and management area correspond to personal electric fence. Administrators can add, delete and assign different forest area to rangers. The system will warn rangers once they are outside the area.
(5) Rangers can send the information such as alarm and distress (include pictures, geographic location) to the administrator. After viewing and judging, administrator can allocate near rangers to rescue.

(6) The system can view all rangers information belong to the ownership of the administrator. At the same time, administrators can modify his (her) information at any time (include they system password).

System Architecture

The rangers can upload information by Beidou terminal or smartphone, then administrator can track rangers’ real-time patrol and attendance status and manage all information through the background system. Figure 1 shows the system architecture [2].

SYSTEM IMPLEMENTATION

The system adopts B/S mode, takes advantage of YII framework with an MVC (Model-View-Controller) architecture, PHP (Hypertext Preprocessor) scripting language and AJAX (Asynchronous JavaScript And XML) technology to create interactive dynamic web pages [3]. The system selects the MySQL database, accesses to ArcGIS for Server and embeds maps provided by ArcGIS for Server and other resources (ArcGIS Online) into Web application by ArcGIS API for JavaScript, takes advantage of WebSocket technology to achieve communication between browser and server [4][5], then publishing in the form of Web [6]. The whole system including user access module, data storage module, integrated application module.
User Access Module

Based on a unified open standard protocol, the module accesses to various types of intelligent terminals and business platforms, provides business access capabilities for terminals with different ability and business systems. The module using 3G, 4G technology, GPS technology and WIFI (Wireless Fidelity) technology. With the support of these technologies, we can complete communications between the user access module, data storage module and integrated application module.

Data Storage Module

Data storage module uses the MySQL database to store information and MySQL database provides the API for multiple languages. The database stores user information of location, alarm and chat. Integrated application module access data from data storage module so as to manage the whole system. Only administrators have the highest permission of data storage module. The rangers can only upload data to data storage module, they have no right to interfere with the management of data.

Integrated Application Module

Integrated application module is divided into three sub-modules, they are user management, communication management and attendance management.

USER MANAGEMENT

User management include managers’ management, friends’ management and rangers’ management. The administrator that has entered the system has the highest authority to manage others. The administrator could add managers and create an encrypted password for them to use system more safe at the same time access to all information of other managers that they can also delete. The administrator can modify the system map that includes electronic maps and satellite maps at any time. All the rangers of a county default to friends and the country number is their group number. The administrator that has entered the system adds rangers to let them upload information that is used to be managed. Administrator also can access to rangers’ information, delete them and assign the ranger an electronic fence.

COMMUNICATION MANAGEMENT

Communication management include chat information management, alarm information management and real-time message communication. For chat
information, manager can view message not only between ranger and ranger but also ranger and manager and they also not only can view real-time message between manager and the group but real-time and history alarm information is sent by rangers. The rangers can send alarm information to manager then after dealing with the information, manager may deploy other rangers to help them. In this part, administrator can look over all friends of a ranger and all rangers of a group.

ATTENDANCE MANAGEMENT

Attendance management is the core module of the system and the module include attendance information management, patrol route management, attendance summary and real-time status updates. Attendance information management is mainly to the ranger specific attendance information for reference. For patrol route management, manager can view rangers’ path, commuter time, effective patrol time and distance intuitively. The attendance summary is used to visually view the annual and monthly attendance status of each ranger, the total patrol time and distance for all ranger.

SYSTEM APPLICATION

At present, the system has been put into use, users reflect the various functions of the system have good main performance, stable running and high efficiency, Meeting the work requirements of the forest staff. The administrator-side running interface shown in Figure 2.
CONCLUSION

The traditional way of attendance is the field staff need to the company attendance sooner or later, the way not only delay time and procedures are complex, but also affect the efficiency of staff and waste management time. The new system to improve the field personnel management provides a more efficient way. The rangers sign in by Beidou terminal or smartphone and manager can look over attendance information and attendance summary on the system intuitively and vividly. Manager can allocate regional tasks better with uploading real-time location information regularly by rangers. And rangers can communicate with manager in real time with taking pictures for emergency alarm so as to change traditional problems such as late, omission and false report and to avoid urgent events happening such as miss fire and deforestation. Practical application shows that the system can not only allows administrators to manage rangers efficiently but can solve various problems encountered in the process of the ranger patrol and protect through real-time monitor and communication. Thereby, the system could protect the rangers’ personal safety as well as promote their attendance impartiality. Besides, it contributes a lot to mobilize the enthusiasm of the ranger and correct their work attitude.

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