

# Design and Implementation of Mobile Intelligent Hidden Danger Inspection System

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## ABSTRACT

With the increasing development of Internet technology, computer Internet, intelligent terminal, cloud computing and other new technologies continue to emerge. All kinds of app based on mobile intelligent terminal are widely used because of its convenience and intelligence. However, for the safety of the coal industry, how to use these technologies based on mobile intelligent terminal to establish a set of efficient long-term mechanism of safety inspection and risk control is a necessary method to upgrade the safety management mode. Therefore, in order to meet the requirements of hidden danger investigation and management, this paper designs an intelligent hidden danger investigation and management system. Based on Ionic, the system constructs a cross platform mixed mode mobile app development framework. The paper shows that the system can realize the basic hidden danger investigation requirements.

## 1. Introduction

In recent years, accidents in the coal mine industry in my country have occurred every year. Even though the government and various units have issued relevant safety documents, there are still no actual actions in terms of specific safety hazards investigation and management<sup>[1-2]</sup>, supervision is not in place, and management methods are backward. Such problems, and such post-accountability

handling methods, are likely to cause the relevant departments to get lucky, and may even cause greater accidents in the future.

Recently, due to the maturity of modern high-tech such as information technology, the number of users of mobile applications is very large, and it has gradually penetrated into all aspects of the entire economy and society. All walks of life are using information technology to arm themselves. According to the existing problems of fire

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safety, Wu Qiming [3] and others designed the fire safety hazard reporting APP, but due to the difference between fire protection and coal mining industry, it cannot be used directly, and they proposed that the hidden hazard reporting mechanism is not convenient for supervision and rectification. . In order to improve the efficiency of coal mine safety management, Chen Qing [4] designed a set of closed-loop hidden danger management system to improve the degree of informatization of the coal mine industry. However, in actual construction, using their methods, even if there are hidden dangers in the investigation, there are still deficiencies in the supervision, control, and rectification of hidden dangers.

With the rapid development of computer technology, the use of modern high-tech to solve the above problems is the top priority of the safety management development of coal mine enterprises. Therefore, this paper proposes to build an Ionic-based mobile intelligent hidden danger investigation and control system[4]. The system integrates real-time entry and upload of hidden dangers, assignment of hidden dangers, supervision of hidden dangers, rectification, review, performance evaluation, etc., with closed-loop management as the construction idea, which greatly improves the efficiency of investigation and rectification of hidden danger investigation and control, and is also for managers. Provides rich views and big data functions.

## 2. System Development Technology

Ionic is a framework for smart component app development based on web technology using html5, css3 and javascript [5]. It is a cross-platform hybrid mobile app development framework called hybridapp framework. Ionic greatly simplifies the APP development of the front-end [6]. Ionic focuses on UI interaction between feeling and applications [7], which is irreplaceable by Phone Gap [8] and Cordova. This project uses the Ionic framework to develop this mobile smart security hidden danger APP from the web perspective [9]. The client side uses JQuery AJAX technology [10], and the server side uses MVC-based hierarchical design ideas and uses Java language [11] for writing.

## 3. System Introduction

### 3.1 Setting up the Organization for the Investigation of Hidden Dangers

The hidden danger investigation system [12] relies on the four levels of the head office, branch, contractor and work team. The head office can browse and manage the

hidden danger information submitted by all departments. A branch includes a security department and a business department. It can only manage the hidden dangers submitted by its subordinate departments and can view the hidden danger information of other branches. The contractor belongs to the business department of a certain branch company, receives related hidden danger information and conveys the rectification of its work team. The work team receives the hidden danger information and submits it to the superior for acceptance after rectification. The network architecture at all levels is shown in Figure 1.

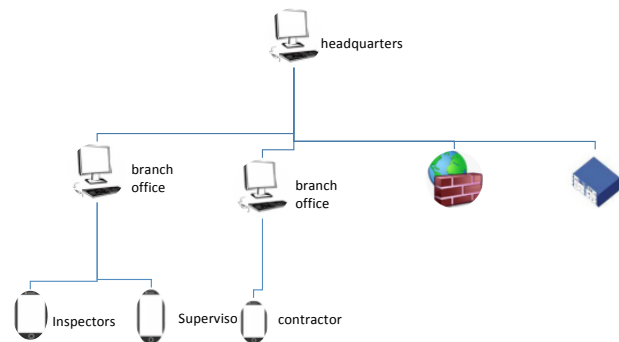


Figure 1. Network architecture

### 3.2 Business Process of Hidden Danger Investigation

The basic business process of hidden danger investigation are as follows: All levels are basically closed-loop management of hidden dangers in accordance with investigation, reporting, recording, governance, acceptance and review.

- 1) Investigation: General inspection personnel, safety department personnel and business department personnel shall carry out investigations one by one according to the contents of the hidden danger investigation, and if certain items have hidden safety hazards, they will be dealt with.
- 2) Reporting: When investigators consider that there are hidden dangers when dealing with hidden dangers, they will assign departments on the system or directly submit them to the work team for rectification.
- 3) Processing: The work team will deal with the hidden danger information after receiving it and submit it to the contractor for acceptance.
- 4) Acceptance: The contractor and inspectors check and accept hidden dangers. If they are unqualified, they will be rejected for rectification.
- 5) Audit: Relevant departments will review the hidden dangers after they have passed the inspection and rectification to eliminate the hidden danger information.

### 3.3 Classification of Hidden Dangers

The hidden dangers [13] in specific construction can be roughly divided into the following four categories [14]: hidden dangers during rectification, repetitive hidden dangers, qualification hidden dangers and overdue rectification hidden dangers. According to the completion status of hidden dangers, it can be divided into hidden dangers that have been rectified and hidden dangers in rectification.

In principle, hidden dangers are submitted by ordinary inspectors, relevant personnel of the security department and relevant personnel of the business department. The rectification of hidden dangers shall be specifically implemented by the work team under the contractor, which shall be reported and checked and accepted in different grades, and the declaration, rectification and acceptance of hidden dangers shall be completed and recorded.

## 4. The Design of Each Module of the System Function

According to different permissions, the interface display is also different, and the functional scope of each user is shown in Table 1.

### 4.1 Head Office and Branch Management Page-Home Page

The general manager, deputy general manager, director of the QHSE department and related employees of the head office, general manager and deputy general manager of the branch company can see this interface. The head office personnel automatically display all data, and the

branch personnel account automatically displays the relevant data of the branch company. Click on the relevant data in the pie chart or histogram to jump to the data details page.

### 4.2 Headquarters and Branch Management Page-Contractor Situation

Headquarters and branches can view the ranking of contractors, and the points for this month are displayed by default. The contractor's monthly initial points are 100 points, and points will be reduced according to hidden dangers found. The penalty value is linked to the risk level, with 1 point for low risk, 3 points for medium risk, and 10 points for high risk.

### 4.3 Headquarters and Branch Management Pages-Inspection Personnel

Headquarters account to view the inspection status of all personnel, and branch account to view the status of branch inspection personnel. The personnel in this function are divided into inspection personnel and supervisory personnel.

### 4.4 Inspector and Supervisor Interface

Inspectors and supervisors mainly inspect the operating points of the branch. Inspectors' monthly initial points are 0 points, and points are added according to hidden dangers found. The bonus value is linked to the risk level.

Inspectors can click on the hidden hazards to be accepted on the homepage to open the list of hidden hazards to be accepted. Click on a hidden hazard to be accepted to

Table 1. User range

Serial number	interface	interface brief description	Main users
1	Head office and branch management interface	It is mainly used to control safety hazard information at the company level and branch level. You can view the statistical analysis of various data, contractors, operating points, inspection personnel and specific hidden danger data. The head office account can view all data, and the branch account can view the data of the branch.	General manager, deputy general manager, director of the QHSE department and related employees of the head office, general manager and deputy general manager of the branch.
2	Inspector and supervisor interface	Inspection personnel and supervisors are used for: 1. Online inspection and submission of potential safety hazards on mobile terminals; 2. On-site acceptance and safety hazards; 3. Maintenance work point information; 4. The director of the QHSE department and the director of the business department of the branch will assess the level of hidden dangers.	Director of the QHSE Department of the branch, related employees, director of the business department, related employees and supervisors.
3	Contractor interface	Used by the contractor: on-site rectification of hidden dangers;	Contractor account number.
4	Public interface	Shared by all accounts.	All accounts.

open the site hidden hazard acceptance page. If the hidden danger acceptance fails to meet the standard, you can fill in the rectification requirements and rectification period again, add on-site photos, and submit again, and the contractor will receive the rectification agent again.

Inspectors and supervisors, special personnel are set up to maintain operating point information. The current contractor of the operating point is information that changes frequently and needs to be maintained in a timely manner.

Inspectors and supervisors can view the acceptance history of hidden dangers at the branch office. Inspectors and supervisors can view hidden dangers that have not been rectified after the expiry date. The overdue time is displayed in the list of hidden dangers that have not been rectified after the due date. The overdue time is in hours.

#### 4.5 Contractor Interface

The main responsibilities of the contractor in the system:

1) Rectify the hidden dangers detected by the inspectors;

The list of hidden dangers to be rectified displays the main information of the hidden dangers and the rectification period.

When the rectification period is more than one day, it will be displayed in green, and when it is less than or equal to one day or overdue, it will be displayed in red. After the on-site rectification is completed, click the list to open the hidden danger details page, and click the rectification completed.

2) Perform regular inspections and punch cards for operating points.

The contractor can view the hidden dangers that have been checked and accepted.

3) The contractor needs to check in regularly for the work points within the work scope.

The clocking cycle is different for different job sites, and the clocking cycle is maintained in the job site maintenance function.

#### 4.6 Common Interface-Operating Point Information

Inspectors and supervisors mainly inspect the operating points of the branch. Click the plus sign to jump directly to the hidden danger investigation and report page of the operation point.

#### 4.7 Common Interface-Knowledge Base Function

You can view and add knowledge base manual learning reference

#### 4.8 Public Interface-Personal Center

Each account has a personal center function, which is used to receive system messages, viewpoints details, and switch accounts.

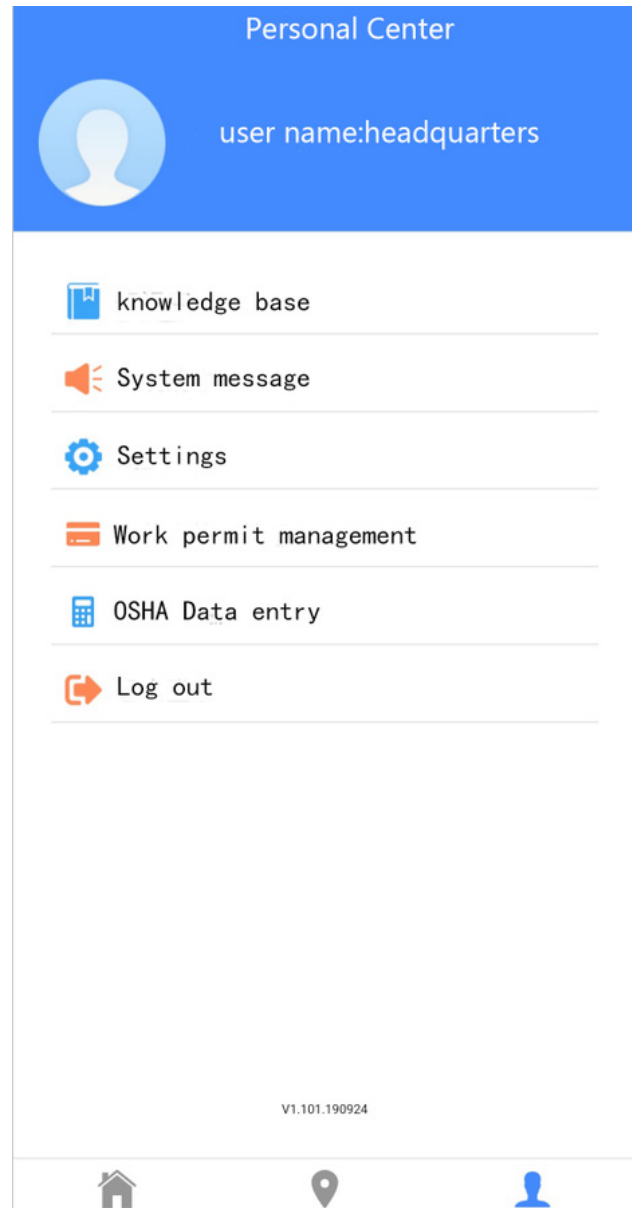


Figure 2. Personal Center

#### 5. Conclusion

The system is an intelligent mobile hazard investigation system established by coal mining enterprises. It uses the Ionic-based framework to design a mobile APP<sup>[15]</sup> to make the existing hazards more visible. The closed-loop system management design model also makes each Company managers and inspectors can also grasp the hidden danger situation more accurately, and carry out better

rectification, review, etc. for hidden dangers. The system further improves the efficiency of hidden danger handling and effectively establishes a closed loop of hidden danger investigation and management in the coal mine industry mechanism.

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