

# Research on Intelligent Evacuation APP of Mobile Phone under BIM Platform

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**Abstract.** With the acceleration of urbanization process, the difficulty of building firefighting has greatly increased due to the complex structure and huge space in the building. When the fire occurs, both the fire position and the development trend of the disaster have a strong randomness, it is very important to quickly determine the position of the fire and accurately and effectively evacuate the people in the building. The three-dimensional visual intelligent fire evacuation system is proposed based on BIM technology, which can realize the management of building information and equipment information, in addition to the Internet of things technology, real-time upgrade of information can be achieved, so that the fire environment can be quickly and efficiently understood, which can greatly improve rescue efficiency of firefighting, and VR and virtual game technology are integrated, real-time feedback is conducted when users play games, and system updates. This system provides more information services to users through the storage of building information.

**Keywords:** building, firefighting, information technology, internet of things, QR code, game.

## 1. Research Background

With the acceleration of urbanization in our country, the functions of buildings are different, the evacuation exits are various, and the evacuation paths are complex and diverse, on the other hand, basic firefighting publicity and education still have dead angles, some citizens' security awareness is weak and lack basic fire prevention, fire extinguishing and self-rescue escape common sense. In addition, with the increasing improvement of people's living standards, various high-grade household appliances are gradually popularized, and the daily use of fire and power is increased, and the probability of fires is also increasing, accidents that cause casualties and property loss occur from time to time

At this stage, the two-dimensional evacuation diagram is provided in the building, which has defects such as poor intuitiveness, and it is impossible to obtain the fire specific situation of fire and flexibly adjust the escape path. Moreover, due to the complex building structure, and the fire evacuation diagram in the two-dimensional mode is difficult to effectively display the interrelationship among the spatial information, equipment information and personnel information, which is extremely unfavorable for the selection of the evacuation path. In addition, different fire points also directly affect the choice of evacuation path. Therefore, the traditional evacuation diagram as the evacuation guidance way cannot meet the evacuation guidance requirements of large buildings. The traditional fire management system cannot fully understand the fire scene, the surrounding fire facilities layout and the structure of the fire area, etc., it is difficult for firefighters to find out the fire point, understand the fire situation and work out the best rescue path in the shortest time.

We hope to use the latest technology of building information and the Internet to solve the problem of people's fire-fighting problems and it becomes the opportunity of our project. We propose 3D visual intelligent fire evacuation system based on BIM technology, which can realize the management of building information and equipment information, in addition to the Internet of things technology, real-time update of information can be achieved, so that the fire environment can be quickly and efficiently understood, which will greatly improve the efficiency of fire rescue.

## 2. Technical Background

### (1) Visual integrated firefighting design

BIM technology can be used to realize the design of various professionals, and it is synchronized to a central file in the form of information model, virtual collision check is conducted, and pipeline

conflicts can be found out in time, various professionals coordinate and cooperate, correct design, avoid problems in later construction, and affect expected fire safety function standards.

(2) Integration and share of firefighting equipment information

The core of BIM technology is lots of data information (including firefighting equipment information) carried by the building information model, this information is continuously updated and improved as the project advances, and the information will be updated and supplemented in the application and maintenance process of the subsequent firefighting facilities. By integrating information from different stages and participants in this way, the efficiency of information selection and utilization is improved.

(3) Fire emergency plan of high-rise buildings based on BIM technology

The BIM technology is used in the active firefighting design model, the required building structure information and firefighting equipment information can be quickly extracted. It is more intuitive in 3D state and convenient for on-site decision. In addition, different fire scenarios can be set up, and BIM technology can be used for fire analysis and simulation, in addition to the final result of the simulation, the firefighting zone, firefighting passage, evacuation route, firefighting door and other information collected in the passive firefighting design are integrated, it can more effectively work out fire rescue and personnel evacuation plans and guide the implementation of fire rescue.

(4) Development of the Internet of things

With the development of the Internet of Things technology, information collection methods are diversified, such as RFID, QR code, video surveillance, sensors, etc., through the coverage of these information collection devices, firefighting equipment, fire passage, and safety exits of buildings can realize real-time monitoring, etc., thus achieving real-time information collection and generate digital information, and then this information is transmitted through the wireless network or wired network. Based on the open standard of BIM model data, the data collected and transmitted by the Internet of things can be accessed into the model through the BIM port according to the agreed data transmission protocol. Moreover, according to the actual position of the firefighting facilities and equipment, the 3D model established by BIM gives an ID number to the position of the facilities and equipment in the building, and the information collected through the Internet of things can be stored in the corresponding ID number, thereby realizing the 3D visual management of firefighting facilities and equipment, the immediacy and accuracy of information will be greatly improved.

(5) Virtual games and VR mobile phones

Virtual reality is a new way for people to visually operate and interact for complex data through computers; experiencers use special devices to interact with the environment in a near-real way in this environment, operate and control the environment, and experience the real situation in an immersive experience. The BIM building information is introduced into the mobile phone system, and creates a virtual reality to conduct visual operation and interaction of complex data through the fire simulation game; the experiencers interact with the environment in a near-real way in this environment, operate and control the environment, simulate safe evacuation environment, in case of safe evacuation when real dangerous situations occur.

(6) Application of immersive virtual network environment in fire education

1 Network teaching

The key to immersive network teaching is to develop an advanced network teaching environment and creates meaningful scenarios. The immersive network environment has made the network teaching experience return from "virtual" to "real", which makes the network become a real learning space.

## 2.1 Virtual Laboratories

Virtual laboratory has become a reality abroad. In a virtual laboratory system, modeling tools and simulation technology are used to display different experimental materials in the window, students are free to choose; for some instruments, the physical model and the digital panel can be combined to produce a real feeling.

## 2.2 Fire Simulation Training

The virtual reality of firefighting is to use virtual reality technology to create a simulated on-site environment, so that students can train in an almost real environment to consolidate the study of professional knowledge, and lay a solid foundation for flexibly and actively handle complex fire conditions in the future.

## 3. APP Product Service

### (1) Provide the safest evacuation route

After receiving the fire alarm, the APP sends the signal to the user's mobile phone, it prompts the user to evacuate the fire and plan the safe evacuation route in the shortest time. During the evacuation of the user, the mobile APP knows the evacuation information in the building at any time, if the mobile APP receives a secondary alarm signal during the evacuation, the original evacuation route will be re-planned immediately to ensure that the user can safely evacuate from the building.

### (2) QR code regulation

After entering the building, the users scan the building information QR code posted in the building, and then import the building information into the APP, and the APP conducts analysis and processing, and stores the building information to provide the user with the required functional services. Once the fire breaks out in the building, the mobile APP pushes the fire message to the user's mobile phone, and provides the users with the position of the nearest firefighting equipment, by scanning the QR code on the firefighting equipment; the user opens and uses the firefighting facility to ease the disaster.

The QR code on the firefighting equipment is also used by the building's managers, by scanning the QR code on the firefighting facility; the manager can obtain information about the firefighting facility and learn about the use time of the firefighting equipment to replace it.

### (3) Game simulation function

Through the stored building model information, the APP develops a mobile game simulation function, which is both entertaining and educational, and it makes users to learn about firefighting knowledge in the daily life. Through the virtual animation scene simulation, it can publicize and popularize fire protection knowledge.

Through the user's evacuation simulation of mobile games, the mobile APP collects the user's game information, analyzes the reaction and psychology of the users when encountering dangerous situations in the game, and adjusts the function push of the mobile APP in real situations to meet users' spiritual needs.

### (4) Information storage and push function

The APP stores various position information in the building, the users enter the building and scan QR code, obtain the building model information, help the users quickly find the target location, and saves the search time; moreover, the mobile APP receives the merchants' information, provides the user with the search of the merchants, push its activity information to give users further choices.

## 4. Development Prospect

APP can prevent fire very well, once the fire breaks out, it can notify the fire department at the first time, it guides the fire department to arrive at the scene accurately and quickly to launch fire rescue and reduce personnel and property losses. When the fire occurs, the crowd at the scene can immediately see the specific situation of the fire, avoid the crowd emotion out of control, the safe escape route is calculated through the BIM platform, and guides the crowd to escape safely and orderly, and achieve zero casualties.

Because the nature of the firefighting APP determines its broad prospect, its promotion and use will inevitably be strongly supported and actively promoted by the government. The government can choose to demonstratively promote in some important public buildings, cooperates closely with the fire department, and gradually promotes it until the final completion of complete fire safety system network covering all the cities' public infrastructure, including gymnasiums, libraries, natatoriums,

restaurants, high-rise buildings, residential buildings, etc. The chance of fire is effectively reduced, the loss of life and property caused by fire are reduced, and create a safe and secure network for citizens. In the promotion process, considering the interest demands of the merchants, we can use the combination of government subsidies and advertising to promote mutual benefit, under this model, the merchants cannot only publicize their platform, but also fully protect their property security, achieve two things at one stroke, jointly build a complete fire safety protection network.

## Acknowledgements

This paper was funded by the 2019 University Student Scientific Research Project of Wuhan Polytechnic University. (NO. xsky2019083).

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