Design and Application of Consumer Security Intelligent Integration Platform in Tobacco Industry

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Abstract

In order to innovate the security management model of tobacco enterprises, effectively improve the company's risk pre-control ability, ability to actively identify potential hazards, early warning and emergency response capabilities, and realize the transition from the traditional passive "artificial protection" safety management model to the active "technical protection + artificial protection" The transformation of the integrated management mode of fire safety and security, based on the new generation of information technology such as the Internet of Things, artificial intelligence, big data, and the characteristics of the tobacco industry's fire safety management and actual business scenarios, proposes the design concept of an intelligent integrated fire safety and defense platform, and builds a corresponding management platform. Realizes the overall perception of the production site of the tobacco company, the intelligent identification of hidden dangers, and the integrated linkage of safety and security in the emergency scenario.

Keywords

Safety information, intelligent fire fighting, Internet of Things, artificial intelligence, tobacco industry.

1. Introduction

The tobacco industry is one of the important pillar industries of the national economy and an important guarantee of the national tax revenue. The safety management of tobacco production enterprises is an important part of the enterprise development strategy, and it is an important guarantee to achieve the business objectives and improve the economic benefits [1]. With the transformation of economic development mode and the adjustment of industrial structure, tobacco production enterprises fire control security, safety production, security management is facing the new challenges, combined with the tobacco production enterprises as a special industry, with large investment, long production line, tobacco flammable, in the event of the accident spread, big loss[2], therefore, tobacco production enterprise security management is very important.

According the survey, the current fire control and safety management of tobacco enterprise adopts the traditional human-centered prevention mode, These models have some shortcomings, such as insufficient security checks, incomplete basic security infrastructure configuration, outdated on-site monitoring technology, and low application of security information products[3]. So traditional management mode need information means to improve the management level. With the penetration of the new generation of information technologies such as the Internet of Things(IoT), big data and artificial intelligence technology in various

industries, the application of information and intelligent information in the tobacco industry has also ushered in a period of rapid development. Therefore, how to make use of the new generation of information technology in tobacco industry's security management, and promote the digital and intelligent transformation of security management has become an important problem faced by the tobacco industry [4].

Focus on the tobacco industry fire control and safety management issue, using the IoT, artificial intelligence, big data, such as a new generation of information technology, make "front content holographic perception, intelligent identification analysis, eliminate security integration linkage" as the breakthrough point, build security intelligent integration platform, innovative enterprise security management mode, facilitate the shift in management approach from human-centered prevention to a combined human-physical-technological defense system., build enterprise fire and safety management informatization, the new pattern of intelligent.

2. Platform Architecture Design

According to the tobacco industry security management demand, and following the hierarchical design philosophy, the architecture is structured from the bottom up into five layers: the IoT Perception Layer, Network Service Layer, Support Service Layer, Application Layer, and Unified Integration Portal, complemented by two standard specification systems and a Security & Operation Maintenance Assurance System, collectively forming a 'five-layer, two-system' architecture. [5], as shown in figure 1.

IoT Perception Layer: including traditional fire fighting facilities, intelligent water pressure detector, intelligent liquid level detector, gas detector, network intelligent camera and other front-end sensing and information collection iot equipment.

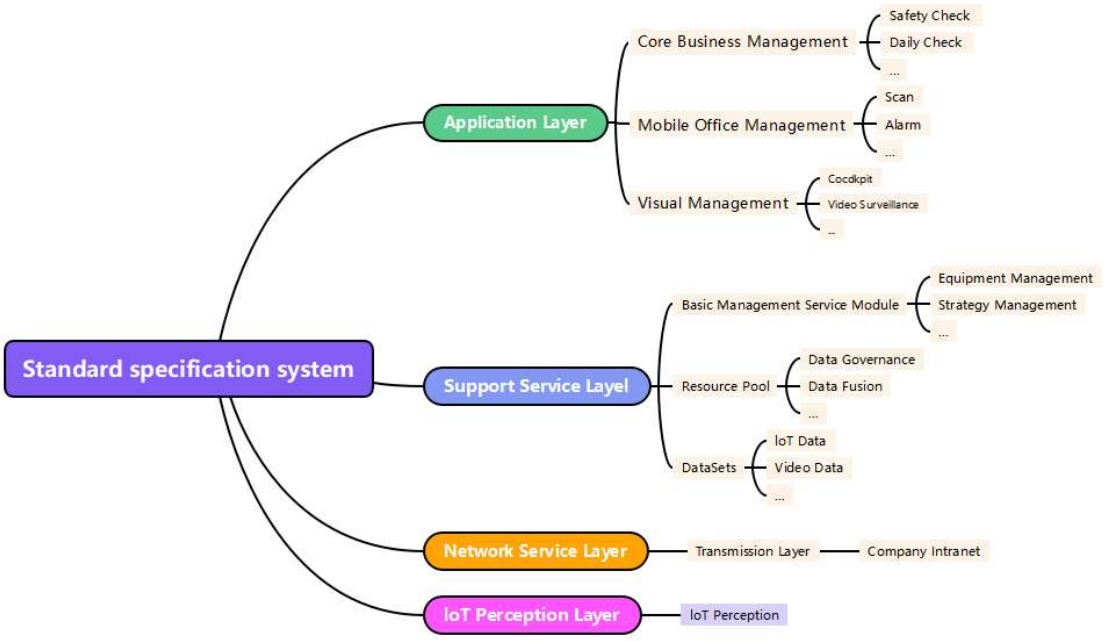


Figure 1. Architecture of the platform5

Network service layer: adopt virtualization and pooling methods, provide computing resources, storage resources, network resources, management resources, backup resources, security and disaster recovery resources, and divide resource pools according to services to provide corresponding services.

Support service layer: including four application support service modules: intelligent sensing service module, intelligent monitoring service module, data analysis service module and basic management service module.

Application layer: it is divided into three application modules: core business management, mobile office management and visual management.

Unified integrated portal (comprehensive display layer): Provide various carriers such as PC terminal and mobile APP terminal, to provide all-round, multi-dimensional and multi-perspective display application services, and realize convenient access and visual display of services and applications.

Standard and specification system: In accordance with the principles of systematization, coordination, practicability and advancement, unified standards and specifications shall be established to provide technical specifications for information exchange and sharing among various platforms and systems.

Security and operation and maintenance guarantee system: Through physical security, network security, system security, application security, and terminal security protection, Establish an information-based operation and maintenance guarantee mechanism for combining independent operation and market-based operation and maintenance, To provide unified information security and system operation and maintenance services for hardware and software equipment facilities and business application systems.

3. Technologies and Modeling Methods of the Platform

Around the platform overall architecture of functions, business and services, focus on content perception, artificial intelligence, image recognition technology, data convergence analysis and visualization technology in the field of tobacco industry security management business application, establish targeted technology model, realize the front-end domain content perception, hidden dangers intelligent identification and eliminate security intelligent integration management.

3.1. IoT-based Full-domain Real-time Sensing Technology

Tobacco industry fire and safety management involves video monitoring facilities, fire control facilities, boilers, production equipment facilities such as front-end facilities, according to the connection into the requirements, for different types of front-end facilities, based on narrowband communication technology (NB-IoT, LoRa), development special gateway (content transmission device), design access software protocol and access scheme, configure the corresponding auxiliary facilities such as router, switch [6].

(1) Video surveillance and holographic linkage technology. Based on the integrated visual linkage requirements of consumer security services, the video surveillance is connected to the platform to provide support for the realization of emergency command, intrusion alarm and other functions. Two access schemes are provided for enterprise stock video: first, the front-end equipment manufacturer will upgrade the equipment to support GB / T 28181- -2016 protocol; second, add a new video access private gateway to integrate the front-end.

Upgrade access scheme: Video access and intelligent analysis support module is based on the GB / T 28181-2016 protocol, realizing the direct access of video monitoring equipment (IPC, NVR, etc.) in accordance with GB / T 28181-2016, and providing the core-function of remote viewing of real-time video, historical video, cloud head control (PTZ) through the Internet "end-cloud" direct connection.

Video gateway access scheme: For video surveillance devices (IPC, NVR, etc.) that meet ONVIF, GB / T 28181-2011 protocol and 326 third-party private protocols, the LAN video device protocol can be converted by access video gateway equipment, so as to realize active

registration of devices and push video image data to the cloud platform on the Internet. The video access gateway can automatically discover the camera, NVR and DVR devices of the enterprise Intranet. Through the simple configuration process, it can realize the seamless and fast networking of the enterprise video, and can guarantee the network security of the Internet. Through the one-way connectivity technology of cross-network segment, the video gateway only need to monitor the router / switch in the private network and provide the Internet uplink, and the security link between the monitoring private network and the video access and intelligent analysis support platform can be opened through the video access gateway.

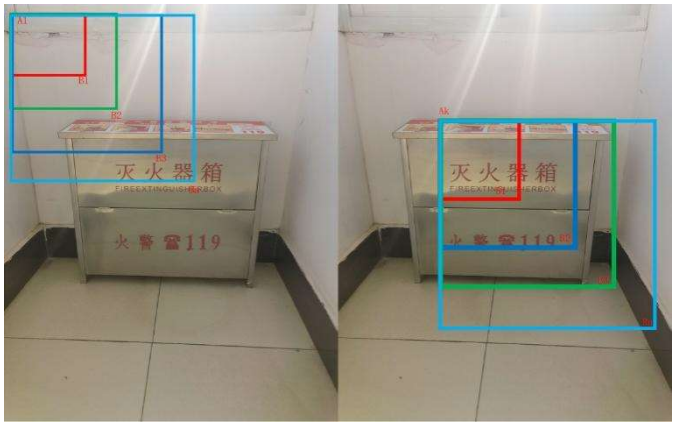
(2) Multidimensional sensing technology of iot facilities. Iot equipment includes fire alarm control host, boiler control host, natural gas leakage control host and other control equipment, as well as iot equipment used for sensing the signal of traditional fire fighting facilities and monitoring the field water pressure, liquid level, temperature, flame and other data. By creating an external data access port, the COAP and MQTT communication protocol, and the platform PC terminal and mobile terminal will be used,By creating the event subscription and forwarding interface, the early warning events issued by the iot device are pushed to the relevant service or application [7] in real time.

3.2. Intelligent Hazard Recognition Method based on Adaptive Reference-Image Hazard Database

In order to solve the problem of intelligent identification of hidden danger, a hidden danger identification method based on adaptive benchmark image hidden danger library is proposed, and the intelligent identification of hidden danger is realized according to the process of "creating text hidden danger library-creating benchmark image hidden danger library-obtaining image to be recognized-image registration-image hidden danger library update". Through the field sample collection, the original benchmark image hidden danger library is established, and the training samples are transformed differently with the help of the common digital image processing methods, so as to increase the diversity of data and enrich the benchmark image hidden danger library. On this basis, the loss function is used to train the detection model repeatedly and iteratively to improve the image registration level, and at the same time, the benchmark hidden danger image library is automatically improved to improve the accuracy of hidden danger identification, and improve the hidden danger type [8]. Among them, sample preprocessing, training and detection model establishment and optimization are the core of this method.

(1) Sample preprocessing includes two steps: image normalization and sample annotation. The raw images to be processed were first transformed into the corresponding unique standard form by coordinate centralization, x-shearing normalization, scaling normalization, and rotation normalization. Then, for the original images, the opencv computer vision library is used to write the image annotation program, and save the annotation information of the images in batches to generate the training sample with labels.

(2) Training and testing model establishment and optimization. A modified Faster-RCNN network was used to image-detect [9-10] for specific objects in the image. The critical task of image detection is the generation of candidate regions, which can be used to generate candidate regions. A is A pixel on the image, B is another pixel on the bottom right of A, A, B can determine A rectangular box, written as AB. As in Figure 2 (A), A takes the top left corner of the image except A to generate the rectangular frame A1B1, A1B2,..., A 1 Bn; and in Figure 2 (B), A takes A position in the middle of the image and B traverses all the lower right positions of A to generate the rectangular frame AkB 1, AkB 2,..., AkBn.



(A) Traverse all positions outside the upper left corner
(B) Perverse through all positions on the lower right
Figure 2. Candidate region

During the detection process, the number of detected targets is controlled by constantly adjusting the threshold value, thus changing the accuracy and recall rate.

Among them, the positive case is correctly classified as a positive case, expressed as TP (true positive), and the positive case is incorrectly classified as a negative case as FN (false negative). The negative case is correctly classified as negative as TN (true negative), and positive as FP (false positive). Precision rate P is defined as:

Precision = TP / (TP + FP), and the recall R is defined as: Recall = TP / (TP + FN). A PR curve corresponds to a threshold value, and AP (Average Precision) is the average accuracy, namely, by averaging the Precision on the PR curve,

$$\int_0^1 p(r)dr$$

In the target detection of multiple object categories, mAP (mean average precision) is generally used as the accuracy index, that is, AP is calculated by a PR curve obtained by adjusting the threshold, and the average AP of all categories is mAP:

$$mAP = \frac{1}{M}\sum_{j}^{M}(AP)_j$$

Figure 3 below illustrates the detailed evaluation effect of the model at different thresholds. The horizontal axis is the different thresholds set, and the vertical axis F1-score is the harmonic mean of precision (precision) and recall (recall). The precision rate represents the ratio of the number of positive samples correctly classified by the classification model to the total number of positive samples (i. e. the sum of the number of correctly classified positive samples and the number of incorrectly classified samples); the recall rate represents the ratio of the number of correctly classified positive samples to the total number of correctly classified samples (the sum of correct positive samples and correctly classified backsamples).

$$F1\text{-}score = \frac{2 * precision * recall}{precision + recall}$$

For the detection of multiple objects of different categories, F1-score takes the average of different categories, namely:

$$F1\text{-}score = \frac{\sum_i^n (F1\text{-}score)_i}{n}$$

The n in the equation represents the total category in the detection model. According on the evaluated effect, in actual use, the threshold is set at 0.9.

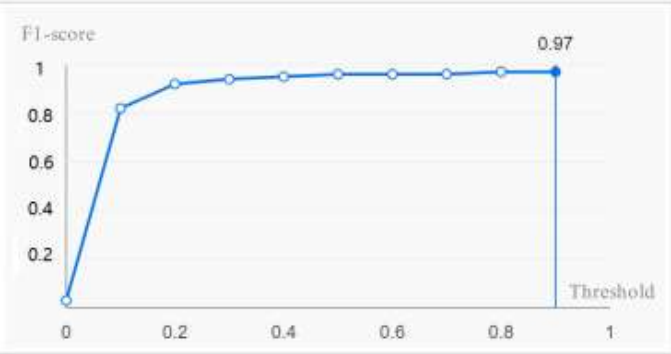


Figure 3. detailed evaluation of the model

After obtaining the detection model with high accuracy in the above steps, the model can be deployed on the public cloud server or private server through independent Rest API. Users only need to use the APP to take field pictures during the inspection process, and the background automatic analysis intelligence gives possible hidden dangers.

3.3. An Integrated Modeling Approach based on Data Processing and Visualization Technology

Based on the construction of data center construction, through the data convergence, conversion and cleaning, fusion sharing data processing process, output function, service data, combined with content perception, video linkage, visual modeling technology, realize safety fire management business aggregation and linkage and data three-dimensional comprehensive display, so as to realize security intelligent integration.

(1) Multidimensional data fusion and processing technology.① Data aggregation refers to loading data of different business systems into data warehouses. Data aggregation mainly includes file transmission, data extraction, content crawl and message push, etc.② Data transformation and cleaning is to achieve through column mapping, derived columns, conditional split, sorting, join, aggregation, SQL script, Java script and other means of data merger of multiple different data sources, transformation and synchronization of different data sets, data type and format conversion, data separation of different target tables, etc.③ Data fusion and sharing is divided into exchange part and sharing part. The exchange part includes pre-exchange, central exchange, data quality and distributed request service, which mainly realizes the security data exchange with the business system of various departments, controls the data quality, and forms a unified and standardized shared resources; the sharing part includes resource directory, data retrieval, data permission, etc. to provide unified service for centralized and decentralized resources.

(2) Intelligent video linkage technology. The principle of video linkage technology is to access various cameras, DVR, DVS, and streaming media servers and other video equipment, through intelligent image recognition and processing technology, active early warning of events, and

through real-time analysis, the alarm information to the software platform. Intelligent video analysis applications of consumer security include intrusion detection, personnel departure detection, face recognition, flame detection, smoke detection and so on.

(3) Cluster operation flow management technology. Through the integration of integrated development environment, workflow engine, report designer and data modeling tools such as application development suite, the fragmented service from the perspective of convenient user to series, process design, form customization, monitoring, index analysis, documents, information or tasks according to certain process rules between participants, and support homework flow independent maintenance, automatic matching, visualization.

Taking the fire emergency linkage as an example, The field monitoring image and image analysis technology based on the front-end video monitoring equipment, to identify whether there is fire; based on the smoke sense, temperature feeling, flame detector, gas monitor and fire alarm controller, obtain the fire alarm information in time. When it is confirmed as fire, push the event information and action instructions to the relevant personnel in the first time, and display the GIS map and two-dimensional model, automatically link the surrounding video camera, and display the internal personnel location information, emergency resource distribution information, surrounding water, police and rescue force distribution information in the map, providing support for the emergency command; the event information and resource distribution, the emergency handling personnel can handle on-site according to the system action instructions, and the site personnel conduct emergency escape according to the system alarm information and escape route information.

4. Platform Application Analysis

(1) Mobile hidden trouble detection function based on intelligent tags. The tobacco industry attaches great importance to the investigation of hidden dangers in key control areas or key equipment facilities such as boiler room, production workshop, special equipment and key parts, The platform features intelligent tags with NFC function at the points of safety inspection, daily inspection and fire inspection, Support inspection, Or use a mobile terminal with NFC capabilities to sense closely with smart tags, Complete the inspection and patrol inspection tasks, At the same time, the personnel identity and location information is automatically transmitted to the platform, To realize the intelligent inspection and patrol inspection, So as to prevent personnel missed inspection and fraud, Ensure that the hidden trouble investigation work in key control areas or equipment and facilities is in place.

(2) Intelligent function of AI identifying hidden dangers based on image recognition. In the process of hidden trouble investigation, the intelligent function of AI hidden dangers, which are hidden dangers is developed. When users use the APP to perform security inspection and daily inspection tasks, they can retrieve the hidden danger identification function. After taking photos and uploading, the back end of the platform will conduct image recognition and registration, and the front end will output the hidden danger identification results. Using this function can not only solve the problem that employees can not identify hidden dangers and hidden dangers is not comprehensive or accurate, but also continuously accumulate hidden dangers database and improve the ability of employees to identify hidden dangers.

(3) Operation site supervision function based on mobile video. The tobacco industry involves dangerous operations such as high altitude, fire, lifting, restricted space, fumigation and insecticidal, and demolition. In view of the high risk, hidden danger, involving the characteristics of the subjective factors of personnel, combined with the operation process, conduct and mobile monitoring demand, with tobacco enterprise safety production standardization specification (YC / T 384-2018) and the enterprise production safety rules and regulations, operating procedures, combining the mobile video technology, research and

development work site supervision function. Set the specified operation of dangerous operation, including safety technology disclosure, on-site monitoring and punching, support users to use mobile phones or on-site video, real-time communication, review and monitoring, realize the informatization of operation process, standardized operation process, visualization of operation process, operation monitoring and mobile intelligence, ensure the dangerous operation process without dead corners, and effectively avoid accidents.

(4) Visual management based on BIM modeling. Based on BIM modeling and visualization technology, realize the production workshop, boiler room, control room, administrative building, restaurant building 3 d, two-dimensional visual display, and the fire control facilities, safety inspection, daily inspection, hidden trouble management, facilities alarm, event alarm and other kinds of data to eliminate security picture, data CARDS, statistical charts, messages, etc in the form of intuitive display.

To sum up, the key functions of the intelligent consumer security integration platform have a great role in promoting the consumer security management of tobacco enterprises, which can not only improve the quality and efficiency of work, but also put the work into practice, reduce or avoid the emergence of problems such as formality and laziness.

5. Conclusion

(1) through the research and development of flame detector, water pressure monitor, noise sensor front terminal and middleware, implements a variety of fire control facilities, security equipment, monitoring equipment, boiler host, gas leakage alarm host equipment access, meet the tobacco production enterprise real-time production site fire, security, hidden danger, environment, occupational health data demand, realize the production site full-time global monitoring, extends the enterprise security management tentacles.

(2) By setting multi-scene emergency linkage rules, the integrated linkage of fire elimination and security in scenes such as fire alarm and illegal personnel intrusion is realized, and the ability of enterprises to deal with emergencies is improved.

(3) Using the hidden danger identification method based on the adaptive benchmark image library, we innovatively applied the artificial intelligence image recognition technology in the field of hidden danger identification in the tobacco industry, and broke through the technical bottleneck of improving the ability of hidden trouble identification of enterprises.

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