Design and Application of Intelligent Epidemic Prevention Monitoring System Based on Behavior Track

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Abstract. The novel coronavirus pneumonia is highly infectious and has a long incubation period. In order to solve novel coronavirus infection in enterprises, institutions and communities, such as detection and monitoring of early and latent period of pneumonia, contact personnel search and other issues, an intelligent epidemic prevention monitoring system has been developed based on the technologies of no body temperature detection, personnel positioning trajectory analysis, epidemic information filling, data analysis and intelligent alarm. The system has functions of filling in body temperature reports, reworking information, daily attendance cards, epidemic analysis reports, suspicious personnel contact and tracking, etc. It helps to report and isolate patients for treatment timely, and provides powerful data support for comprehensive monitoring of regional epidemic situation, effectively protecting people's health.

1 Foreword

The novel coronavirus infection pneumonia swept the globe during the Spring Festival of 2020. The intelligent epidemic prevention monitoring system based on behavior track is composed of sensors, remote processing module, question detection terminal, etc. By means of non-contact body temperature detection and personnel positioning track analysis, it can make statistics on the body temperature data of the entry and exit personnel, accurately and quickly find the personnel with abnormal body temperature and check the contact suspected personnel, so as to realize body temperature detection, check and report. The system can also realize the key tracking, early warning and warning of returning personnel, and provide powerful data support for the comprehensive situation monitoring of regional epidemic situation in time, which has a broad application prospect in the field of epidemic prevention and control.

2 Architecture design of intelligent epidemic prevention and monitoring system

The system is developed on the basis of the mainstream front-end disconnect-type architecture, including six layers: perception layer, transmission layer, resource layer, service layer, application layer and access display layer. Based on the principle of "quick
detection", "precise alarm" and "stable operation", the system can quickly collect real-time information of employees, realize accurate alarm and analysis, and can display the results of data statistics and analysis through various ways, such as mobile APP and WeChat subscription. The overall architecture of the system is shown in Fig.1.

Figure 1. The overall architecture of the system.

3 The research of key technology

3.1 Technology of non-sensitive temperature detection

Based on the integrated temperature measuring equipment and the authentication algorithm, employees can realize intelligent information matching, automatic temperature measurement and reporting through face recognition or swiping (IC) card. Meanwhile, enterprises can find the abnormal temperature personnel in the first time[1,2].

Figure 2. Hardware composition of non-sensitive temperature detection technology.

The network topology is shown in Figure 2. Senseless detection consists of acquisition processing module, communication processing module and terminal processing module.

1) The acquisition and processing module consists of infrared camera, forehead thermometer, infrared thermometer, identity verification equipment and information acquisition processor.
2) The communication processing module includes a wireless receiver, a wireless transmitter, a wired receiver and a wired transmitter for transmitting the information of the person with abnormal temperature to the terminal processing module.

3) The terminal processing module can search the abnormal body temperature in the monitored area in real-time and dynamically, which can distribute the dispatching instruction information for epidemic situation prompt, personnel tracking and other operations.

3.2 Contact pursuit technology of dangerous personnel based on behavior track

Generally, there is a certain incubation period from virus infection to symptoms of human body. The incubation period of novel coronavirus is generally 3-7 days, the longest reaching 14 days [3]. The incubation period is the key period for the spread of the epidemic. The infected people live and work unconsciously, and those who contact with them are likely to be infected, and continue to spread, resulting in an exponential increase in the number of infected people. This system combines the technology of personnel location and epidemic situation reporting to successfully track the contact of dangerous personnel. It supports two modes: filling in personal behavior track information and automatic analysis of behavior track.

1) The system can register and share suspected virus cases or diagnose the behavior track within 14 days before the onset of the disease through mobile APP, WeChat public number and PC browser, and realize the functions of filling in, signing and querying for employees, teachers and students of organs, enterprises and institutions.

2) When a confirmed case occurs, based on the method of personnel location and the record and analysis of personnel movement track, the system immediately starts the contact tracing work, and finds out all personnel who have contacted the patient during the incubation period of the virus. The system can assist enterprises to carry out isolation inspection and key tracking, realize early detection, early diagnosis, early isolation and early treatment for close contacts while preventing the further spread of the epidemic.

![Figure 3. Schematic diagram of personnel behavior track.](image)

3.3 Data analysis and intelligent alarm technology

Through the comprehensive utilization of data analysis, artificial intelligence, data mining algorithm, knowledge base[4-5], the system makes statistical analysis on the collected personnel temperature data, personnel positioning track data, personnel information, epidemic reporting information, etc., so as to realize the real-time alarm of abnormal personnel information, personnel health assessment analysis, contact personnel...
management in epidemic area, contact query of dangerous personnel, etc. The system provides the functions of body temperature data statistics, automatic upload and download, and multi-dimensional display of epidemic results based on curves, broken lines, pie charts, control charts and other forms.

![Figure 4. Process of data analysis and intelligent alarm.](image)

### 4 Design of the system

1. **Rapid temperature measurement without sensitivity**
   By non-sensitive temperature measuring equipment, such as thermal imager, forehead thermometer, etc., the system can detect the temperature of the personnel in and out, realize the automatic upload of temperature data, and achieve seamless docking with the access control and attendance system, and quickly conduct personnel identity verification. The traffic efficiency has been greatly improved, realizing fast detection of traffic within 3 seconds. The system can realize fast detection of traffic within 3 seconds, greatly improving the efficiency.

2. **Alarm of abnormal personnel information**
   Based on the intelligent analysis algorithm, the system completes the warning of personnel health abnormal information, and realizes the key tracking, and warning of returning personnel and abnormal personnel in the epidemic area.

3. **Intelligent analysis of body temperature data**
   The epidemic information overview module can display the temperature measurement records uploaded by each unit in different channels, and make statistics on the health status and temperature trend in the records. At the same time, it can view the latest epidemic situation of the whole country and the location of the server on that day.

4. **Tracking of personnel**
   Combined with the personnel positioning technology, the system records the movement track of personnel in a certain period of time in detail. Once the suspected confirmed personnel is found, the backtracking work shall be started immediately. The system uses big data analysis algorithm to analyze the movement track of personnel, obtain the list, contact time, location and other information of close contact personnel, and conduct isolation inspection and key tracking to prevent further spread of the epidemic.
5 Application of system

Through on-site deployment test, the system can realize the functions of rapid temperature monitoring and registration, abnormal health alarm, personnel behavior track monitoring and contact query, etc., and achieve the goal of comprehensive control of temperature detection, screening and reporting for enterprise employees and outsiders.

6 Conclusion

The intelligent epidemic prevention monitoring system based on behavior track can effectively monitor people's health status dynamically and inverse query the contact person according to the behavior track of the confirmed person to track and isolate them. It can help to report and isolate the patients, so as to treat them in time, which can reduce the risk of second and third generation transmission and avoid the spread of the epidemic. The system not only supports all-round control of epidemic situation and data statistics and analysis in areas with large flow, such as stations, airports, supermarkets, etc., but also can be widely used in enterprises, institutions and residential areas to achieve health monitoring, access alarm, access frequency statistics and other functions for personnel in the jurisdiction and isolation personnel.

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