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Application of the Monitoring System for Health of the Elderly in the Nursing Home

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Abstract: *With the development of mobile internet of thing technology and remote monitoring technology, which are widely used in nursing homes, a design method of intelligent monitoring system for health of the Elderly in nursing home is introduced. Through internet of thing technology networks in nursing homes, the functions of intelligent monitoring, vital signs monitoring, call alarm, tracking and positioning are realized. Furthermore, due to the instability of mobile Internet, the best treatment time may be missed. Then, in order to better monitor the health status of the elderly in real time, the intelligent reflector technology is applied to the remote monitoring system. Thus, the monitoring efficiency for medical staff can be improved in the nursing home.*

Keywords: *Nursing homes, Intelligent monitoring, Health of the Elderly, Intelligent reflector.*

1. Introduction

With the acceleration of population senility, most of the elderly are facing some problems such as hypertension, hyperlipidemia, hyperglycemia, senility, cardiovascular and Alzheimer's disease and so on. According to the latest data of the National Bureau of statistics, by the end of 2021, China has become the country with the largest elderly population in the world. The population aged 60 and above is 249.49 million, accounting for 17.9% of the total population. Among them, the population aged 65 and above is 166.58 million, accounting for 11.9% of the total population. The prevalence of senile dementia in population aged 65 and above is about 5.6%. Due to that the elderly with the lower self-care ability are prone to sudden accidents, the safety of the elderly has become the most concerned issue in nursing homes [1]. Therefore, the demand for health and medical rehabilitation of the elderly is extremely urgent. However, the resources of the hospital are limited, so it is impossible to keep the elderly hospitalized for observation or often enter the hospital for a long time. This breeds the birth of nursing homes for monitoring health status of the elderly. In [1-2], a remote monitoring system is applied for health and medical rehabilitation of the elderly in the nursing home. Then, applying intelligent monitoring system [3] to home nursing bed. Furthermore, night-time monitoring system [4] is developed to provide a safe environment for the elderly and mitigate the caregiver burden.

With the continuous maturity and application of Internet of things technologies, remote monitoring technology is widely used and various intelligent medical products are emerging. Meanwhile, domestic medical environment, medical devices science and technology have been made great development and improvement. Thus, using remote monitoring technology, the elderly can get better treatment and rehabilitation under the monitoring of medical staff. Furthermore, since the edge server is limited when these end-users seek computational resources from edge servers, a reconfigurable intelligent surface (RIS)-assisted edge computing system [5-6] are exploited to improve transmission performance. In this paper, the application of the remote monitoring system with RIS technolgoy are discussed in the monitoring management center of the nursing home.

2. Problem Analysis for the Monitoring System of Nursing Home

In nursing homes, for most of the elderly with low self-care ability, there are common problems, as follows:

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(1). Although there is a medical department, it is generally one-to-many nursing service, which cannot meet the one-to-one nursing service of nurses.

(2). Medical staff or guardian cannot take care of the elderly at every moment, resulting in that the elderly having sudden diseases are unable to obtain emergency medical treatment in real time, such as heart disease.

(3). The elderly in the nursing home are easy to fall and can't stand up easily due to their poor self-care ability, the self-rescue and seeking help are difficult. If the elderly suffer from the danger of having sudden diseases, the consequences are relatively serious.

(4). Nursing homes are generally equipped with gardens, fitness, entertainment, leisure and other places. With a wide range of activity, it is impossible to monitor each elderly person who is having leisure activities in real time.

In order to solve the above-mentioned problems, based on the development of mobile internet of thing technology, the concept of smart nursing home has emerged and its design flow chart is shown in Figure 1. The multifunctional positioning bracelet and alarm, which are applied to the nursing home, provide real-time location information for the administration center of the nursing home.

More specifically, in the monitoring management center of the nursing home, medical staff or guardian monitor the elderly by cameras, and receive information on the health status of the elderly who wear bracelet and alarm from the WiFi access point (AP) and a small base station (BS). In brief, the functions of the monitoring equipments include equipment processing, alarm processing, checking positing information of the elderly, track query, health data viewing, data interaction, authority management, statistical analysis of the comprehensive physical indicators of the elderly.

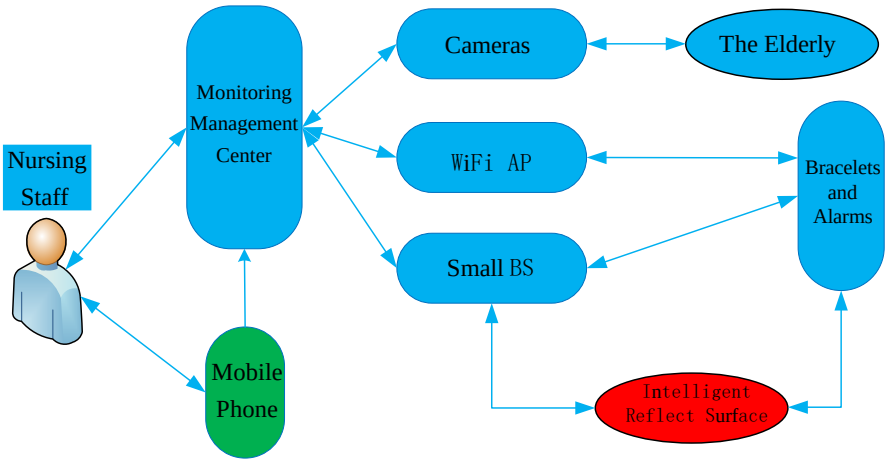

Figure 1: The design chart diagram of monitoring system

According to the design flow chart shown in Fig.1, the main tasks of guardians or medical staff are as follows:

(1). Supervising the elderly. Through the monitoring system, the nursing staff can respond in real time to ensure the safety of the elderly who are having sudden diseases, also find out the location of the elderly and give corresponding help in real time.

(2). By the wireless communication technology, it can quickly and accurately receive the identity and information on healthy state of the elderly.

(3). Through the wireless network, the elderly who need help can call the nursing staff by one key button on the bracelet. Moreover, the nursing staff can receive the distress alarms and obtain the location information of the elderly.

(4). In case of sudden accidents such as falls of the elderly, using the fall alarms worn by the elderly to respond to the medical monitor center in real time, so that the medical staff or guardian can make further medical measures. Furthermore, in case of abnormal heart rate of the elderly, the bracelets worn by the elderly will send their heartbeat to the medical management center in real time, so that the medical staff or guardian can take further medical measures to find abnormal physical conditions.

In addition, in order to enhance the work efficiency of monitoring the health status of the elderly, the

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client APP is installed on the mobile phone, as shown in the green box in Fig. 1. The main functions of mobile APP are: data processing, alarm processing, checking location, track query, viewing health data, data interaction, permission management and statistical analysis.

3. Application of Remote Technology in Monitoring Center

According to the above-designed and analysis, in this section the application of remote monitoring technology in the monitoring management center is introduced. As shown in Fig.2, the nursing home has deployed a remote monitoring network centered on a monitoring department, which mainly includes a small base station, IRS reflector, bracelets and alarms worn by the elderly and various communication equipment to observe the health status of the elderly. The health information of the elderly can be transmitted to the monitoring management center through the bracelets and alarms such as wireless transmission red or black lines of Fig.2.

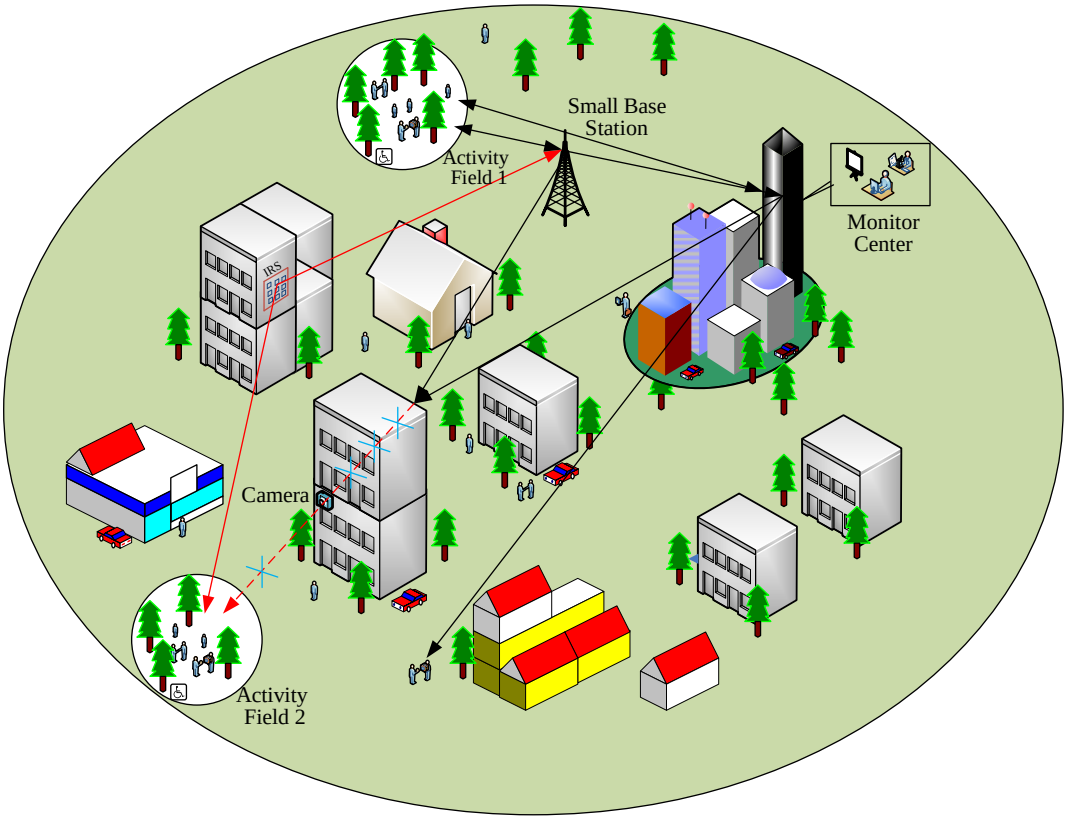

Figure 2: The communication diagram of monitoring system

Furthermore, in order to monitor the health status of the elderly in the nursing home and receive the track information of the elderly's behavior in real time, camera monitoring system and WiFi communication equipment are installed in the nursing home, such as entrance, corridor, bedside, toilet, corridor, activity room, restaurant, etc. Also, to cover sensitive areas, a small base station (BS) is installed in the nursing home to better cover the outdoor public area. For the health status of the elderly outdoor activities in the nursing home, the elderly need to wear a waterproof smart bracelet and fall alarm, which are small, lightweight and deeply waterproof, suitable for all-weather wear. More specifically, through the positioning of bracelet, the nursing staff can receive the real-time positioning. Thus, it is convenient for the nursing staff to understand the location of the elderly. Moreover, the elderly who do not regularly measure blood pressure and take blood pressure lowering drugs are reminded by the call function of the smart bracelet.

4. Application of Intelligent Reflector in Monitoring Network

In Fig.2, intelligent reflector technology is employed. Due to that the smart bracelets sending the health information of the elderly back to the monitoring center rely on wireless communication technology, if the transmit channels are not well, we will miss the best period of seeking help for the

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elderly. For instance, in Activity Field 1 of Fig.2, the monitoring management center can stably receive the information fed back by the elderly in Activity Field 1. However, observing the virtual red line and cross lines of Fig. 2, there are some information delays or even information interruptions due to the instability of the mobile Internet. In this case, some of the elderly who walk into the network edge area such as Activity Field 2 are not given better monitoring in the monitoring center. Consequently, the medical staff cannot monitor the health status of the elderly normally. In order to strengthen the stability of the network and to better monitor the health status of the elderly in real time, an intelligent reflector can be used and installed on a suitable wall for transmitting signal information. As shown in Fig.2, an intelligent reflector is designed and installed on a high-altitude wall and relays the information (i.e. solid red lines) between the bracelets and the monitoring management center.

5. Conclusions

Based on the analysis of both the problems existing in the monitoring system and the life of the elderly in the nursing home, this paper introduces the design flow chart of using the bracelets and alarms to monitor the elderly and the application of remote technology in the nursing home. Furthermore, due to the unreliability of information transmission, in order to accurately feedback the positioning information and the health status of the elderly in real time, the intelligent reflector technology is proposed to apply to the monitoring system.

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