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A High Quality Health-Care System For Mobile-Health Services Based on Priority Considerations Strategy

Zhang Yi [a], Hong-Xin Liu [a**], Zhu-Juan Wang [b], You-Cheng Zhu [a], Wang Bao-Hua [c]

[a] *Wuhan Textile University , School of Electr, Yangguang Road, Jiangxia*
[b] *Wuhan post institu, China*
[c] *Wuhan Dong Hu College*

Abstract

Application of health-care networks is becoming more and more attractive. Electronic-monitoring and movable cameras are the key parts of health - care information collection by mobile electronic devices. Healthy public domain is developed by intellectual approaches. A wide variety of data from electronic-monitoring and movable camera will be stored and shared with continued demand for health-care service demands (e.g.,ECG service, personal pulse service information). However, health-care networks and devices usually share the same frequency spectrum that results in inflexible access sharing. Frequency spectrum access sharing makes the challenge of how best to use electronic health-care information and commutation protocol. We design an priority considerations health-care networks and commutation protocol to enhance quality of access sharing and the users' health-care accuracy by stochastic sharing and protocol optimization. The numerical results show that the health-care networks and protocol can enhance capacity of access sharing for users and spectrum utility of networks.

Keywords: Health-care information, Patients satisfaction, Service capacity, Health-care applications

* Corresponding author : Hong-Xin Liu
Email: hong-xin@google.com

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1. Introduction

The patient information collected is considered to be highly private and sensitive which requires protection [1] [4]. The network is unstable when a node in the network is unstable[3] [5]. We consider a information networks for health-care based on the mobile electronic devices and electronic-monitoring in this work. Several patient health-care data are classed level-I health-care data (the highest priority level), level-II health-care data (the lower level) and level-III health-care data. Furthermore, the classed level health-care data can be processed with others to realize for higher spectrum utility and throughput.

We design our health-care data model (level-I\level-II\level-III) and important events in Section 2. Then, we design health-care network model for the stable state in health-care networks in Section 3. In Section 4, we give the healthcare network performance evaluation. Finally, the patient's sensitive personal health information can be analyzed in Section 5.

2. Health-Care Data Model

Several patient health-care data are classed into level-I health-care data (the highest priority level), level-II health-care data (the lower level) and level-III health-care data in Table.1

Table 1. Level-I\II\III health-care data.

<table>
<tr><th></th><th colspan="2">Level-I\II\III health-care data</th></tr>
<tr><td>Level -I priority</td><td>Electrocardiograph
electroencephalogram
respiratory</td><td rowspan="3">disease and electronic records</td></tr>
<tr><td>Level -II priority</td><td>Blood-
-satisfaction
Oxygen-
-satisfaction
Body fat rate
Bone-density
maximal oxygen consumption</td></tr>
<tr><td>Level -III priority</td><td>Electronic health-care data</td></tr>
</table>

Level -II priority data include Blood-satisfaction, Oxygen-satisfaction, Body fat rate, Bone-density, maximal oxygen consumption. Level -III priority data are Electronic health-care data.

The classified healthcare system can be triggered, shown in Fig.l.

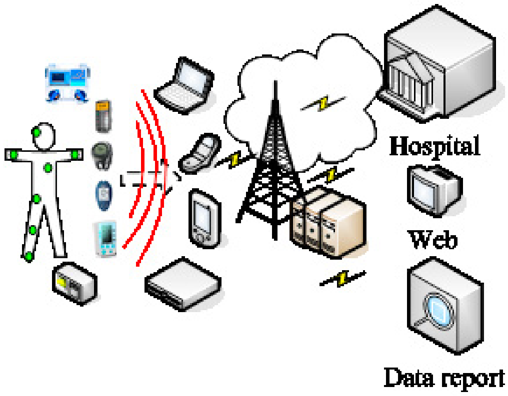

Fig. 1. Classified Access Sharing.

The calls arrival events and service completion events:

(I) Level -I priority event,

(II) Level -II priority event,

(III) Level -III priority event,

3. Health-Care Networks Stable State

The notation of stable state represent the level -I priority data, level -II priority data and the level -III priority in the system, respectively. The level -I priority data, level -II priority data and level -III priority data arrival processes follow Poisson process with x1, x2 and x3. The u1, u2 and u3 can be represent the service times , respectively. They are can be summarized in Table 2.

Table 2. Stable state in health-care networks.

Stable state	
	health-care networks description
a	number of level -I priority user
b	number of level -II priority data calls user
c	number of level -III priority data calls user
m	channel

$$\delta=\{(x,y,z)\mid x+y+z\leq k\} \quad (1)$$

$$\{\xi\mid \zeta_1,\zeta_2,\zeta_3,\cdots,\zeta_k\} \quad (2)$$

$$\sum_j \zeta_i a_{ij} = \sum_i \zeta_j a_{ji} \quad (3)$$

$$A=U+L+D \tag{4}$$

where

$$D=\begin{bmatrix} d_{11} & 0 & 0 & 0 \\ 0 & d_{22} & 0 & 0 \\ 0 & 0 & \ldots\ldots & 0 \\ 0 & 0 & 0 & d_{mm} \end{bmatrix} \tag{5}$$

and

$$L=\begin{bmatrix} l_{11} & l_{12} & \cdots & \cdots \\ 0 & l_{22} & \cdots & \cdots \\ 0 & 0 & \ldots\ldots & \cdots \\ 0 & 0 & 0 & l_{mm} \end{bmatrix} [\ldots] \\ [\ldots] \begin{bmatrix} l_{11} & l_{12} & \cdots & \cdots \\ 0 & l_{22} & \cdots & \cdots \\ 0 & 0 & \ldots\ldots & \cdots \\ 0 & 0 & 0 & l_{mm} \end{bmatrix} \tag{6}$$

$$U=\begin{bmatrix} u_{11} & 0 & 0 & 0 \\ u_{21} & u_{22} & 0 & 0 \\ \cdots & \cdots & \ldots\ldots & 0 \\ \cdots & \cdots & \cdots & u_{mm} \end{bmatrix} [\ldots] \\ [\ldots] \begin{bmatrix} u_{11} & 0 & 0 & 0 \\ u_{21} & u_{22} & 0 & 0 \\ \cdots & \cdots & \ldots\ldots & 0 \\ \cdots & \cdots & \cdots & u_{mm} \end{bmatrix} \tag{7}$$

The level -I\II\III priority users flow chart is described in the Fig 2.

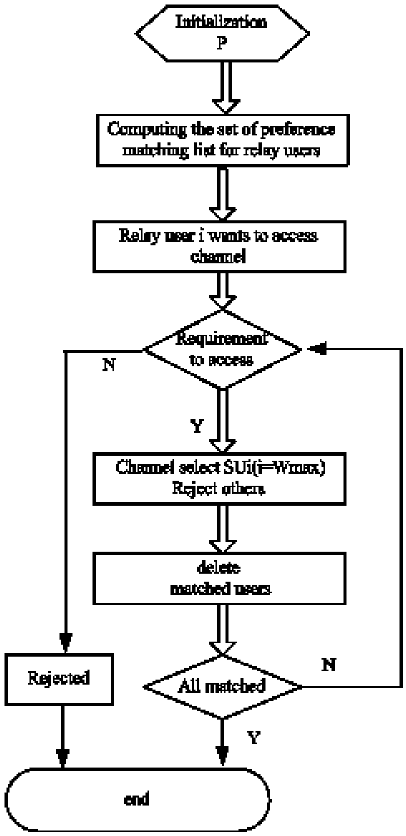

Fig. 2. Stable state and important events in health-care networks .

Details of the algorithm:

```
Initialization.
Set user service time;
for i = 0, 1, 2, ...;
    Set level-I users free;
i = i +1;
SELECT user = first channel on its list;
if level-I user is not on channel's preference list
        then
    delete level-I user;
```

```
     goto SELECT
  end
  if
some CHANNEL is matched to Non Real-Time calls
then
     set SECOND user to be free;
 end
   matching level-II calls,
but level-I calls is perfect than them
       delete level -II user;
     matching level -III calls;
 matching channel;
 for each matched list
     delete user from channel's list;
  end;
 end;
```

4. The Level -I\II\III Priority Users State Performance Evaluation

As shown in Fig 3 and Fig 4, the health-care networks of access performance enhance as the priority users (e.g., Electrocardiograph data, electroencephalogram data, or Blood-satisfaction data, Oxygen-satisfaction data, Body fat rate data, Bone-density data, Maximal oxygen consumption data) increasing.

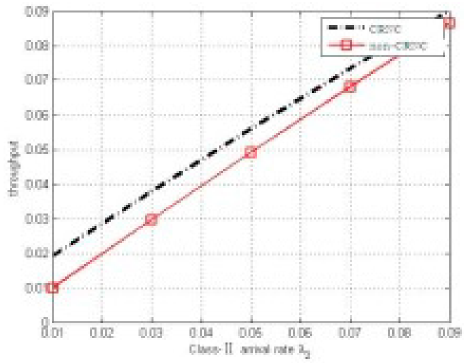

Fig. 3. Health-care networks throughput under proposed policy.

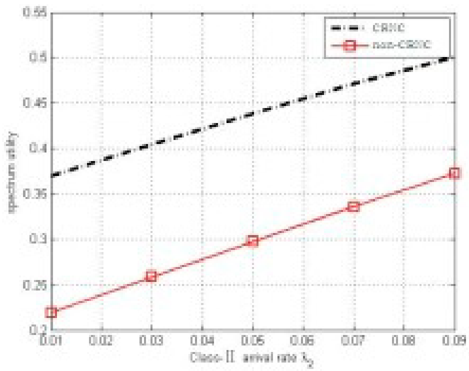

Fig. 4. Health-care networks spectrum utility under proposed policy.

5. Conclusions

In this work, we have discussed patient's sensitive personal health information (PHI) model for scheme of level I\II\III priority. We also developed an application that use priority data scheme. Future work will include implementing scheme for implementing quality of service guarantees.

6. Acknowledgement

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