北京邮电大学无线新技术研究所
BUPT Wireless Technology Innovation Institute

BUPT

Wireless
Technology
Innovation *institute*

# Wireless Remote Healthcare Monitoring in City Communities on Key Personnels

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WTI

- **Background**
- **Our Current R&D work**
- **Project Collaboration Suggestion**

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- **Our Current R&D work**

- **Project Collaboration Suggestion**

- **Unbalanced progress and resource distribution in urban and rural areas；**

- **Weak in public、 community and country healthcare，Morbidity in medical ensurance；**

- **Lack of effective monitoring methods for community key personnels, such as chronic sufferers, the elderly、the childern、patients in convalescence, etc.**
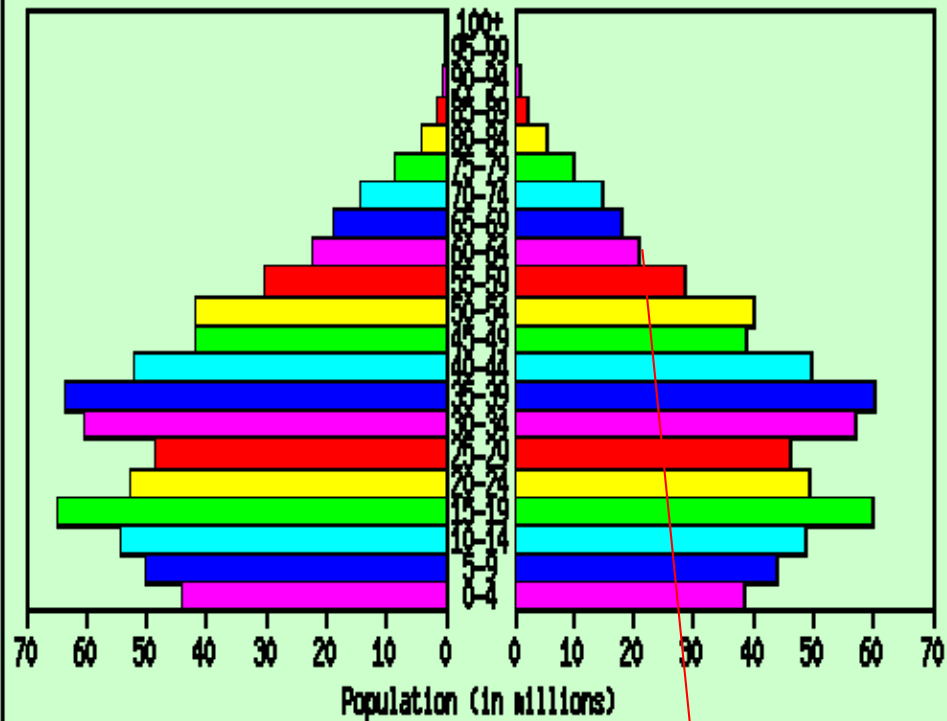
# Elderly Issue in China

In China, Year 2005
**Population：1'306'314'000**
**Average expected longevity：72.3岁**
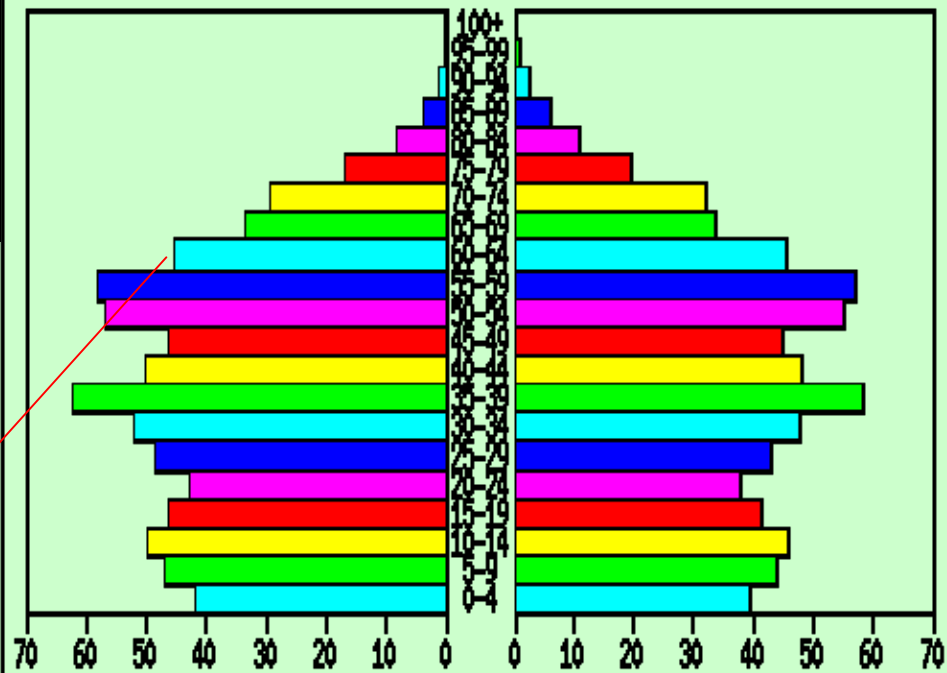
**65+岁人口**

**7.69 %**

**19.9 %**
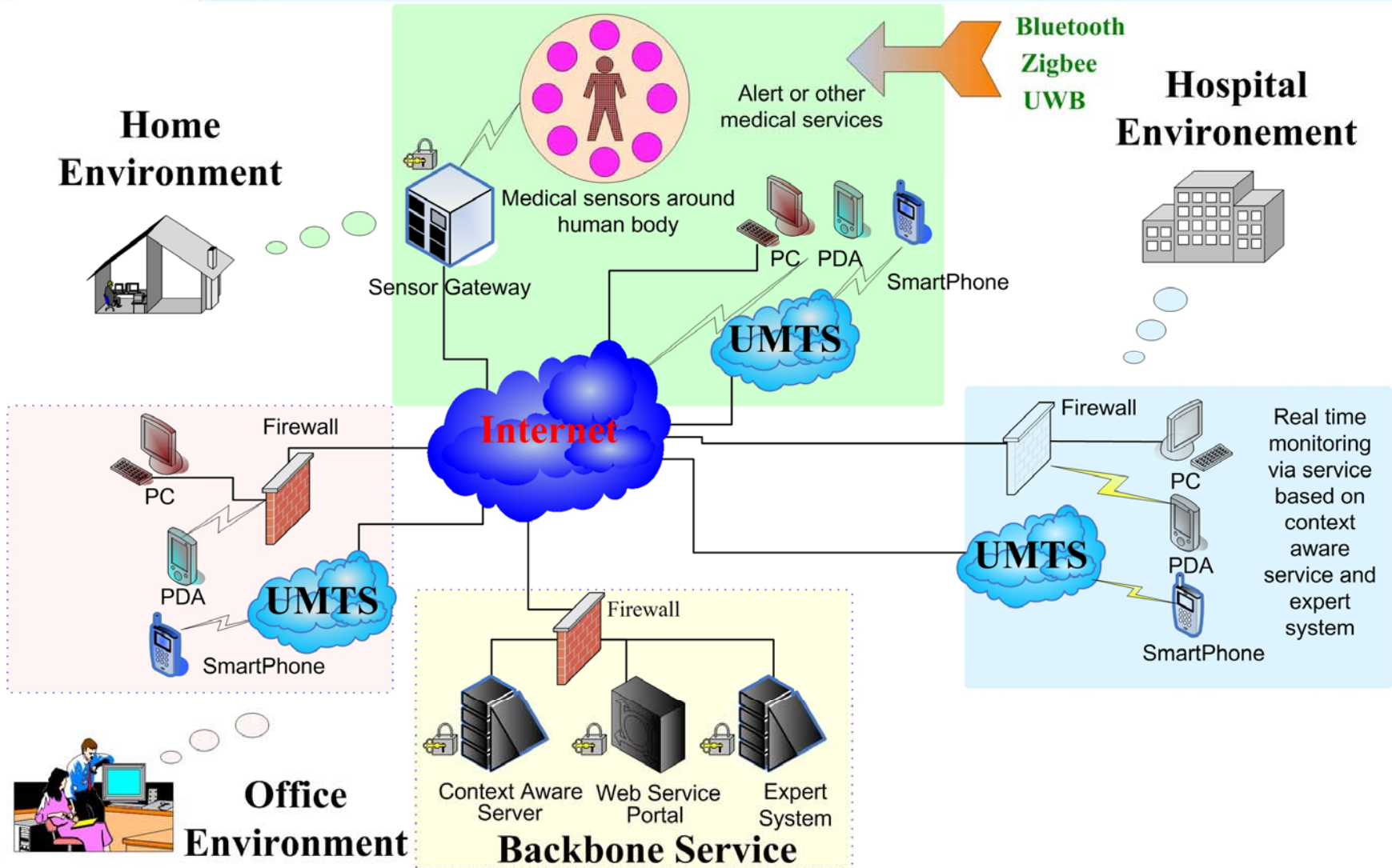
✓ **"to promote novel city medical healthcare infrastructure on the basis of <span style="color:red">community healthcare services.</span> On the purpose of community citizen's health，to provide <span style="color:red">public healthcare services such as disease prevension and control、chronic disease management and rehabilitation.</span> To take the responsibility of citizen's health as '<span style="color:red">goalkeeper</span>' gradually."**

✓ **"（2009-2011）Take 3 years to build matured foundamental medical healthcare service infrastructure."**
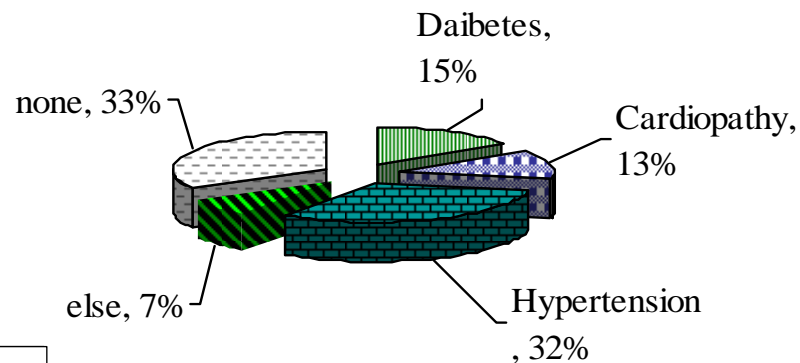
摘自：《中共中央国务院关于深化医疗卫生体制改革的意见》，2009年3月

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**The Types of Chronic in Chinese Family**

Daibetes ▦ Cardiopathy ▧ Hypertension ◩ else ▨ none ▢

Daibetes, 15%

none, 33%

Cardiopathy, 13%

else, 7%

Hypertension, 32%

**Physiological Parameter to be monitored**



Bar chart legend: below 30, aged 30-50

Categories: Pulse, Blood pressure, Electrocardiogram, Cardiotach, Blood sugar, Body temperature, Posture
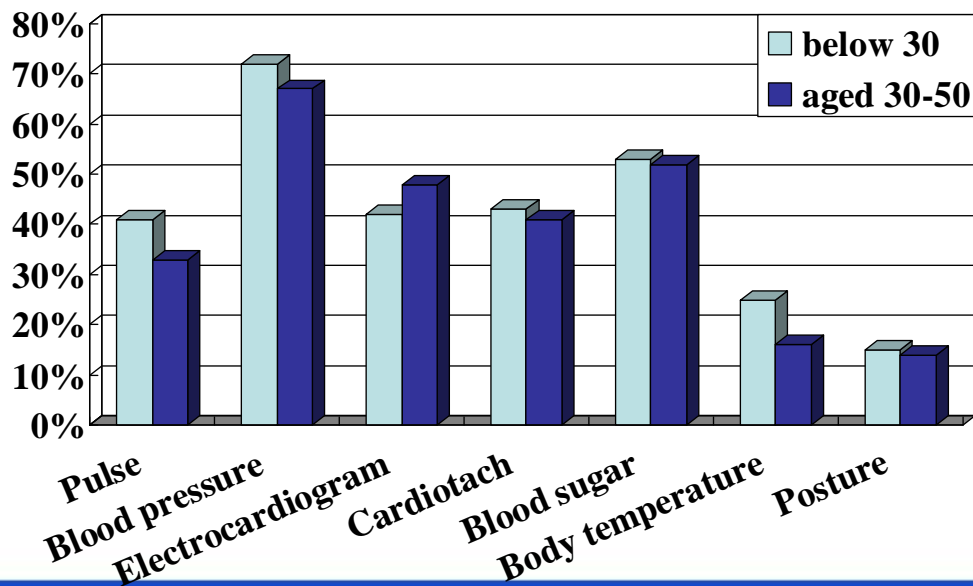
**Worriyes About The Registration Using Cellphones
And The Monitoring Equipment**



Pie chart legend:
- ☐ Negetive effect to body
- ▨ Leak of the health information
- ☐ Hard to use
- ☐ The price
- ▨ Can afford it
- ▤ Accuracy
- ▨ Betimes
- ☐ Taking it conveniently
- ▨ The bit rate with cellphone

Chart values: 42%, 20%, 9%, 52%, 15%, 38%, 60%, 14%, 36%
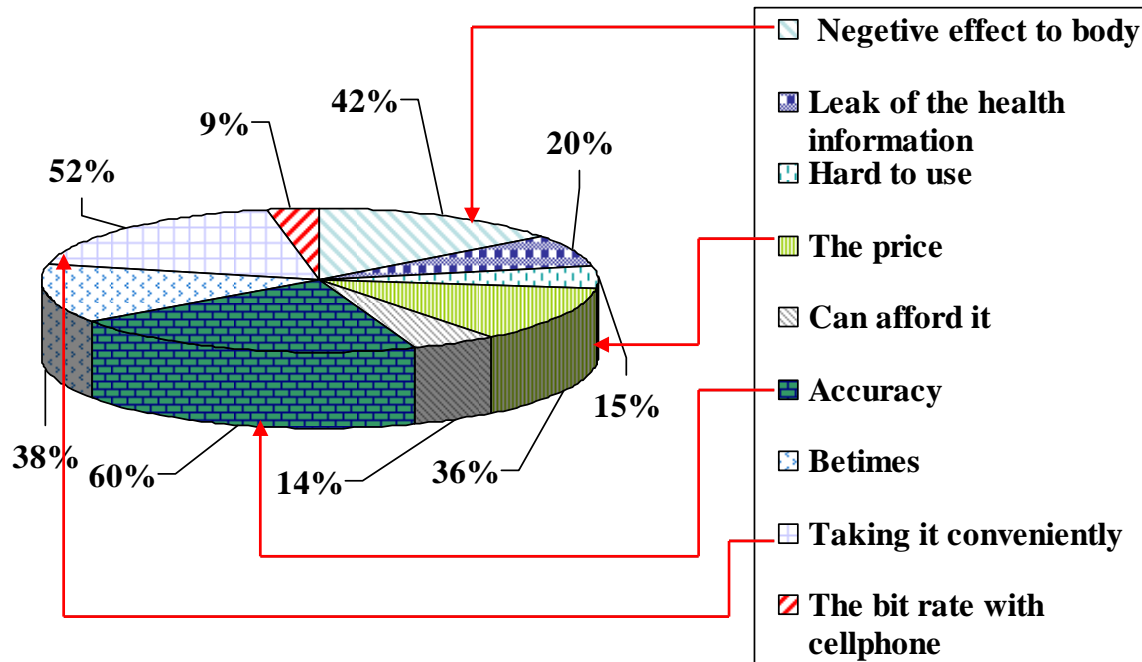
- Worries are inevitably on the newly emerging products
- The accuracy, convenience and possible adverse affect to human body are mainly concerned. So the system should be energy efficient, highly accurate and portable(or wearable)

# Monitoring services required.

| Items | <30 years old | 30~50 years old |
|---|---|---|
| Continual Monitoring in 24 hours | 16% | 15% |
| Customization/personalized | 56% | 56% |
| Results sent to hospital | 17% | 35% |
| The relatives obtain the results | 20% | 41% |
| Get instruction from doctors | 20% | 37% |
| Emergency treatment | 22% | 36% |

**1**

**Theoretical Research:**
•Network structure analysis;
•PHY & MAC technology research;
•Cross-layer design research.

**2**

**Hardware Development:**
• Develop wireless sensor node and sink node
• Integration of the medical sensors into wireless sensor network for wireless remote healthcare monitoring.

**3**

**Services Promotion:**
• Hospital healthcare workflow improvement
• Homecare with remote healthcare monitoring
• Emergency rescue based on wireless sensor network.

## Journal Publications

[1]　Guixia Kang, Da Liu, Yue OUYang, Ping Zhang, "Investigating the performance of IEEE 802.15.4 for medical applications", WSEAS Transactions on Communications, issue 6, vol. 5, pp. 1126-1134, June, 2006.

[2]　Guixia Kang，"Wireless eHealth (WeHeatlh) for the Aging Society in China"，Gerotech Journal，VOL.6, NO. 3, pp. 175-177，July 2007.

[3]　Yue Ouyang, Guixia Kang, Shanghong Li, Xiupeng Chen, "Investigation and Implementation of the Advanced Wireless Medical Registration Solution in China", Lecture Notes in Computer Science, Vol. 4566/2007, pp. 267-273.

[4]　Guixia Kang, Yue Ouyang, Liu Da, Wang Huaqing, Zhang, Ping, "Attitude of Chinese People toward Wireless Applications in Healthcare Industry", Lecture Notes in Computer Science, Vol. 4556/2007, pp. 883-892.

[5]　Guixia Kang, Li Zhang, Shanghong Li, Ping Zhang, Said Boussakta, "Case study of applying wireless technologies into healthcare industry in China and UK", Lecture Notes in Computer Science, Vol. 4556/2007, pp. 874-882.

[6]　Yanyan Guo, Guixia Kang, Ping Zhang, "An emergency access mechanism in IEEE 802.15.4 for wireless body area sensor networks", The Journal of China Universities of Posts and Telecommunications, accepted.

[7] Yanyan Guo, Guixia Kang, Yang Yu, Ping Zhang, "基于网络生命周期最大化的协作MIMO中继节点选择", Journal of Beijing University of Posts and Telecommunications, accepted.

## Conference Publications

[8] 张平，"现代信息通信技术与无线电子健康"，pp.56-64, 2007电子健康论坛.
[9] Huaqing Wang, Yue Ouyang, Guixia Kang, "An energy-efficient cross-layer design for healthcare monitoring wireless sensor networks", VTC 2008 Spring
[10] Yu Cao, Xiupeng Chen, Yu Yang, Guixia Kang, "Range-free distance estimate methods using neighbor information in wireless sensor networks", VTC 2009 Fall, Accepted.
[11] Yanyan Guo, Guixia Kang, Yu Yang, Ping Zhang, "A relay selection cooperative MIMO communication scheme for network lifetime maximization", VTC 2009 Fall, Accepted.
[12] 于旸，康桂霞，郭艳艳，"协作蜂窝网络中基于网络生命周期最大化的中继节点选择算法研究"，Green And Innovative Wireless Mobile Communications, June, 2009
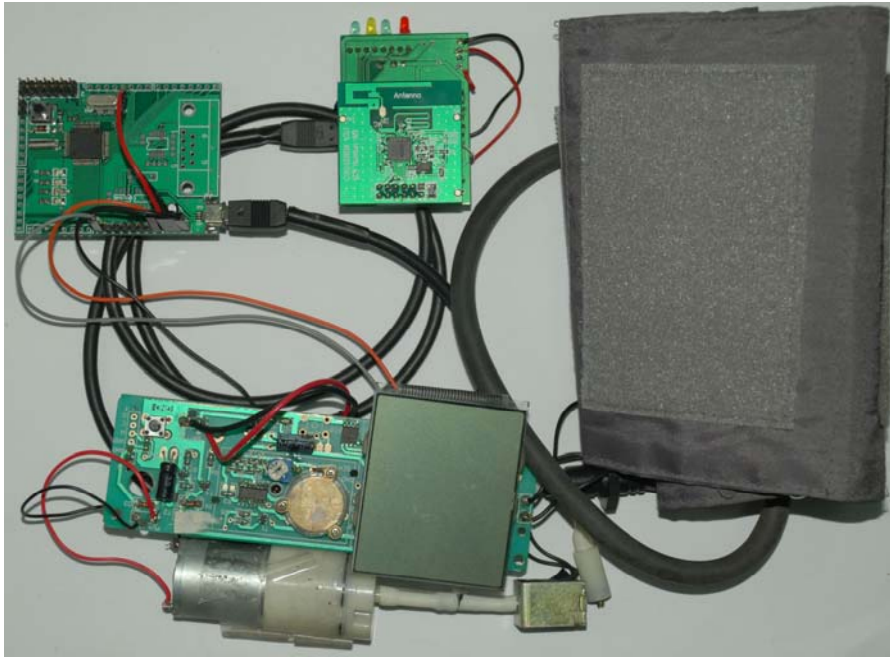
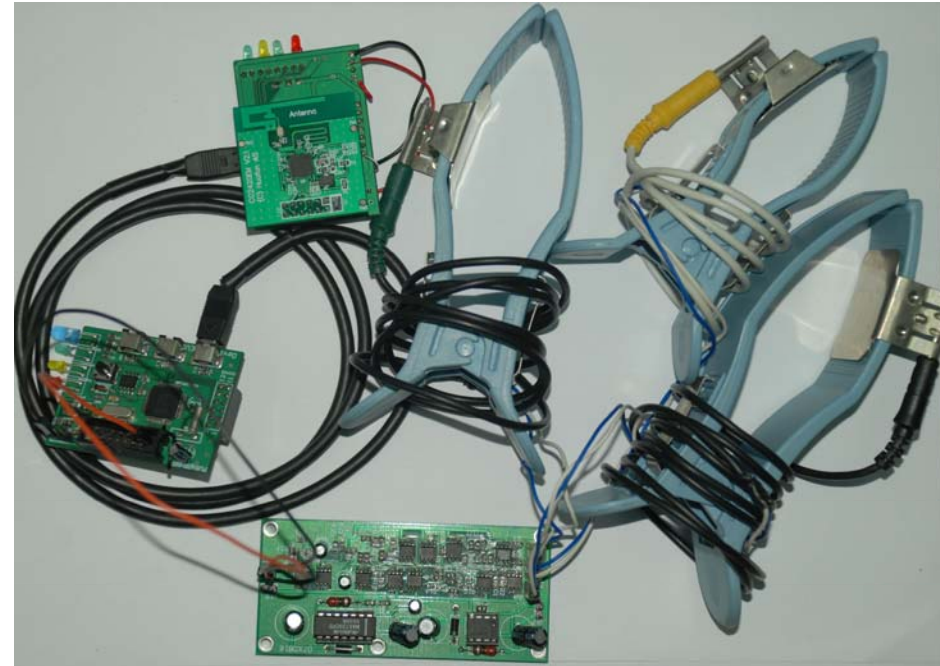Fig. 3. Blood Monitoring Front End



Fig. 4. ECG Monitoring Front End

- Both front ends can communicate with the MACU wirelessly through Zigbee protocol

**Project 1:**

## Public Service Infrastructure and Demo Applications of Modern Population and Healthcare

Sponsored by: **Key Project of National Supporting Plan (2008-2010)**

**Main Partners:**



中华人民共和国国家人口和计划生育委员会
National Population and Family Planning Commission of P.R.China
中国人口 CHINAPOP



北京邮电大学
BEIJING UNIVERSITY OF POSTS AND TELECOMMUNICATIONS

清華大学

中国科学院
CHINESE ACADEMY OF SCIENCES

Wh@ty 北京网梯科技发展有限公司
BEIJING WHATY TECHNOLOGY DEVELOPMENT CO.,LTD

NIS 中国标准化研究院
CHINA NATIONAL INSTITUTE OF STANDARDIZATION

ENGLISH VERSION

Wireless Technology Innovation Institute

- R&D on the systems of remote home procreation healthcare

  - ◆ **Wireless remote physiological multiparameter monitoring system**

  - ◆ **Mobile information platform based on mobile phones**

- To complete the pilot trials of the above system(s) in no less than 200 Family Planning Service Stations, with at least 10,000 users till the end of 2010.

**Project 2:**

**Key Technologies and Systems of Wireless Remote Medical Emergent Rescue in Disaster**

Sponsored by: **National 863 Project (2009-2010)**

**Main Partners:**





**The General Hospital of the People's Liberation Army (PLAGH) (also Hospital 301)**
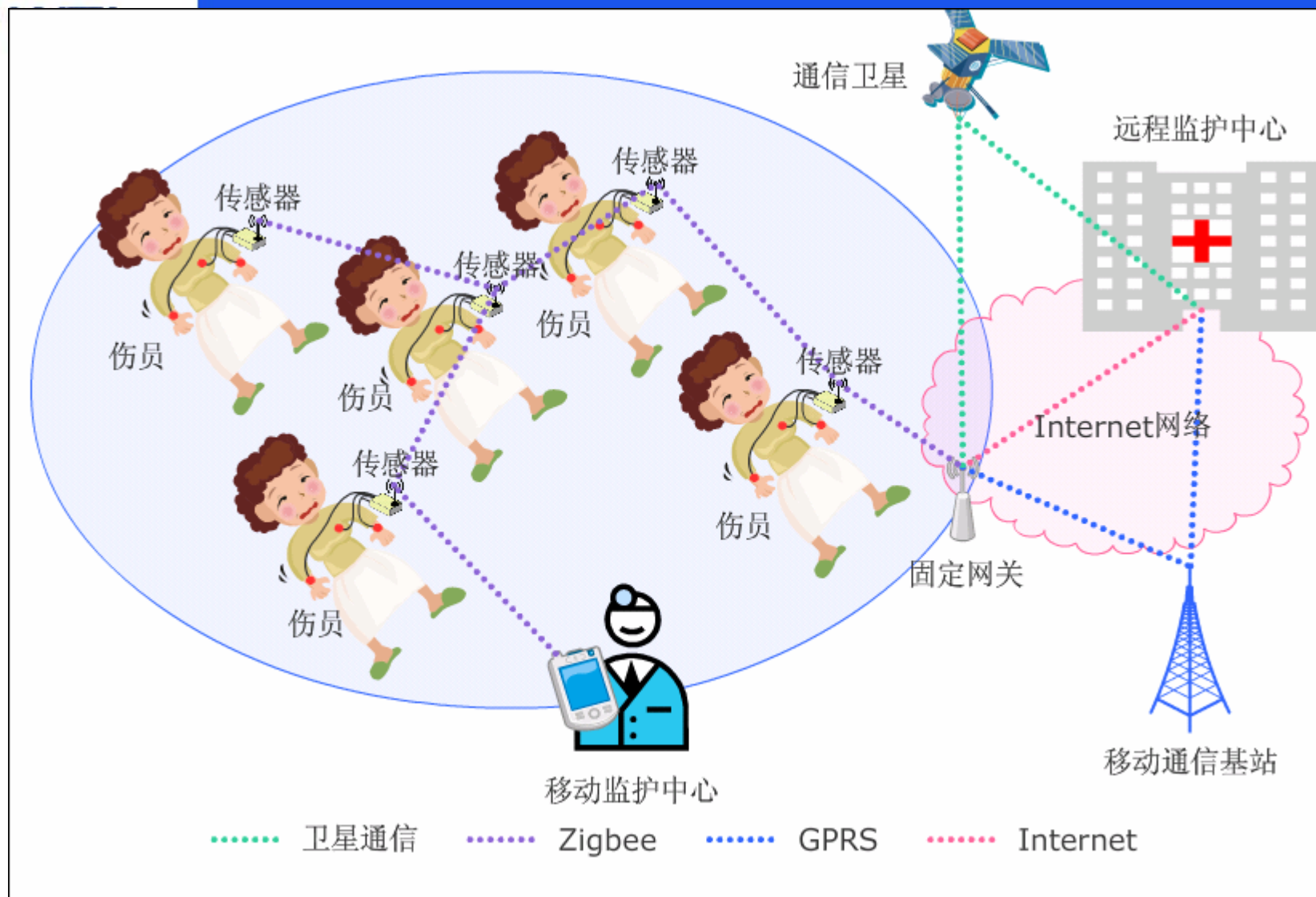
- Research on the remote medical field rescue mode and remote healthcare information standardization;

- Research on the key technologies (such as wireless sensor networking and positioning, etc) in Wireless remote healthcare monitoring;

- Develop the portable wireless remote health monitoring system and build the first-aid database for the injured people;

- Construct of the trial network and carry out pilot trials till the end of 2010.

◆ **In city communities**

◆ **In remote island**

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# Collaboration Suggestion
# for
# China-UK Bridge Project：

## Wireless Remote Healthcare Monitoring in City Communities on Key Personnels

## --- Key Technologies and Service Demonstration

# Technical Routine

**Requirement Investigation** → **Research on KEY Technologies** → **Software and Hardware Development** → **Trial Networks and Service Demonstration**
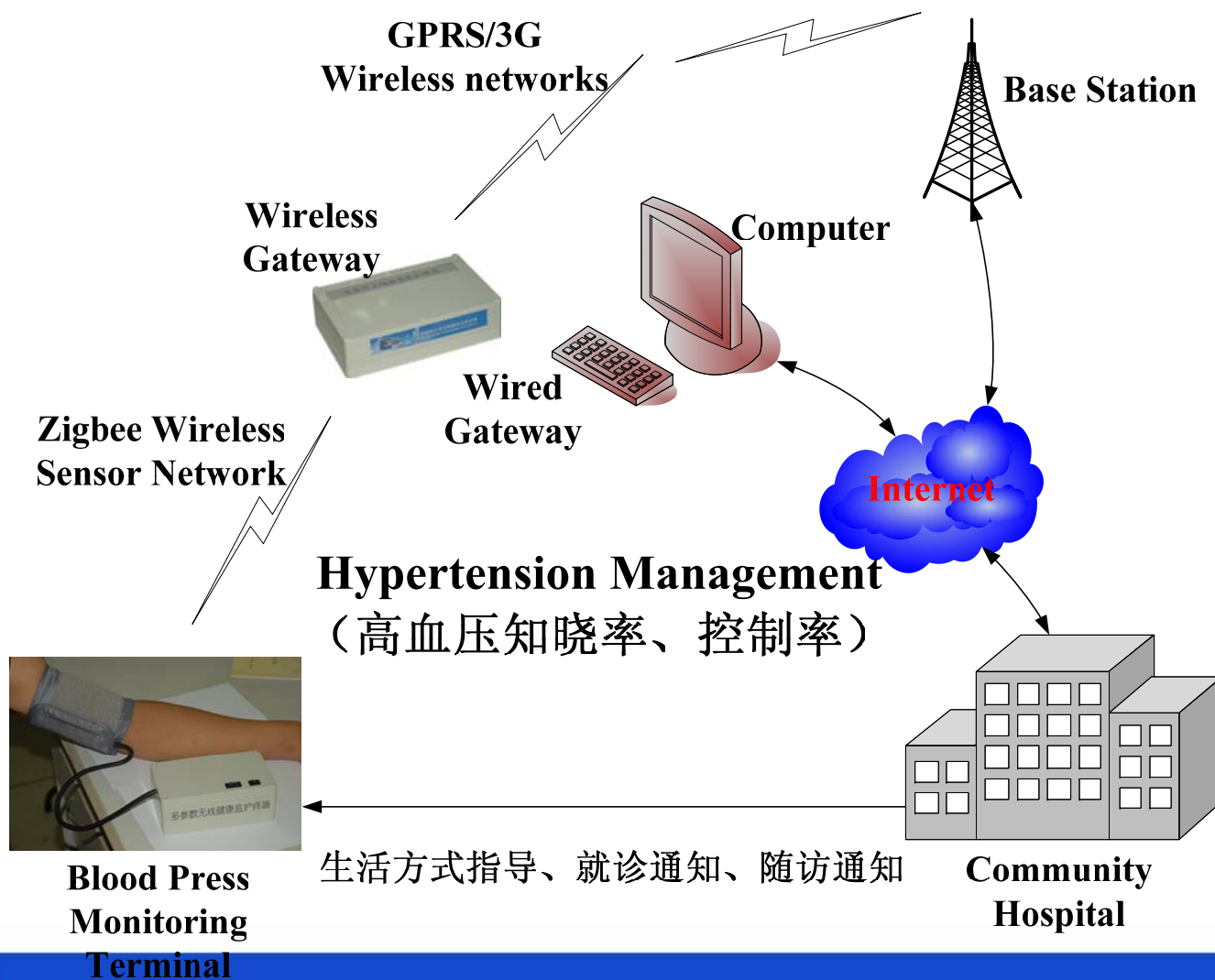
**For key personnels**

- Service mode
- Management requirement
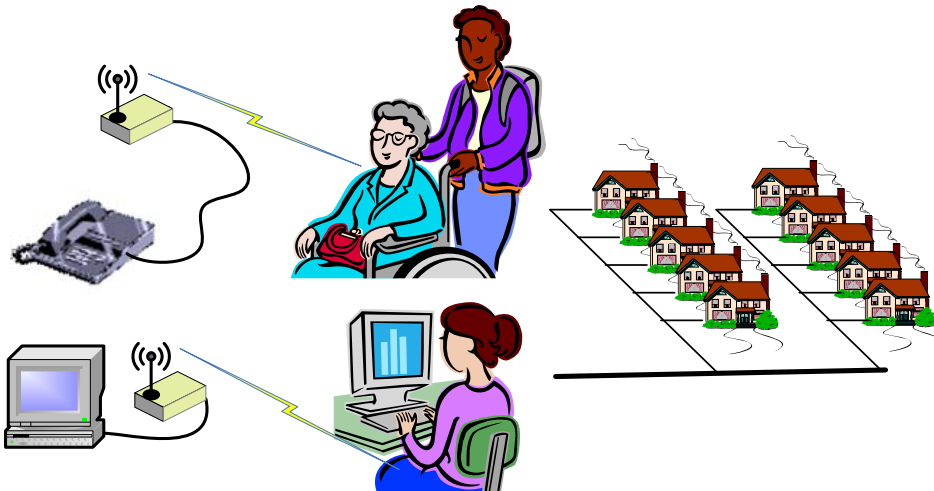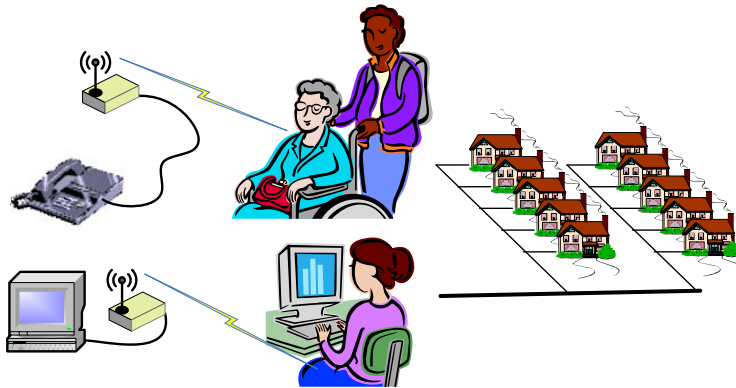- Monitoring characteristics

**Technologies**

- Medical sigal collection
- wireless transmission
- Networking
- Energy guaranteeing
- Positioning

- Multiparameter physical gather and transmission device
- Chip Design of key modules
- Database and Healthcare management system

- Build pilot trail networks with certain coverage and certain number of users
- Service demonstration in 10-20 native communities

**GPRS/3G Wireless networks**

**Base Station**

**Wireless Gateway**

**Computer**

**Wired Gateway**

**Zigbee Wireless Sensor Network**

**Internet**

**Hypertension Management**
（高血压知晓率、控制率）

**Blood Press Monitoring Terminal**

生活方式指导、就诊通知、随访通知

**Community Hospital**

# Community Healthcare and Management



- **Chronic disease statistics and management**

- **Disease prevension and control**

- **Children healthcare and management**

**Ministry of Healthcare (MOH) of China**

# Thanks!