Toward Wireless Hospital
–Snapshot of Trials around the World–

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Abstract— **This paper quickly browses trial researches and introduction attempts of wireless technology into hospital. Most of wireless hospital projects concentrating mobile terminal introduction, location based services, and remote monitoring of patients. To find fruitful combination of conventional medical IT technologies, incoming wireless technology, and optimization of clinical process seems key factor to open up next door.**
Key words: Wireless Hospital, Clinical Benefit, Location Based Service, and Remote Monitoring.

I. INTRODUCTION

Term "Wireless Hospital" is now widely used around the globe. Although basic idea, to utilize wireless technology for clinical benefit, is shared among projects named "wireless-hospital projects", each project gives different definition of the term: some of the projects just introduce wireless local area network into clinics as a part of supporting network for conventional order entry system, or for just voice communication; some of the projects introduce and tests advanced sensor network technology to satisfy complicated clinical wants.

Among numerous trials/attempts toward wireless hospital, most well-knows project is WILHO project [1] performed by University of Oulu, Finland and related research collaborators. The project tests not only wireless clinical applications but also affects of radio wave onto human health. On the other hand, Hospital and Health Networks, a publication of American Hospital Association, conducts "25 most wireless hospitals" survey for several years [2]. The survey tells numbers of hospitals in United States introduces basic wireless local area networks (WLAN) and several wireless applications.

This paper quickly browses research trials and attempts to wireless hospitals.

II. MOBILE TERMINALS – BASIC APPROACH

In many cases, wireless hospital infrastructure means conventional 802.11a/b/g WLAN, and wireless hospital projects simply means introduction of mobile voice or data terminals into hospital information systems (HIS).

Figure 1 shows one of the most typical wireless hospital terminal products. Most of current mobile hospital terminals are based on tablet personal computers (PC) or personal data assistants (PDA), equips touch screen, wireless connections, camera, barcode reader, and additional connection ports. Even it looks attractive solution, however, most widely accepted approach is to mount conventional laptops on clinical wagon and provide recharging stations widely in wards.

Another possible and widely tested terminals are VoIP terminals such as shown in Fig. 2. Trial reports such as Chen et. al. [5] claims VoIP communication reduces infrastructure and communication costs for hospitals, and provides several other benefits. Key challenge of VoIP application is connection stability to ensure smooth communication.

Fig. 1 Motion Computing C5 [3]   Fig. 2 Vocera B2000 [4]

III. TRACKING –ASSETS AND HUMAN RESOURCE

One of the most wanted and most expected wireless service is tracking for asset management. Most of the commercial tracking products such as active/passive RFID or WLAN positioning tags (Fig. 3, 4) claim themselves good for asset management, especially to avoid medical equipments to be stolen. Although simple introduction of such wireless technology gives certain amount of benefits from management point of view, careful process designing [8] or coupling with sensor networking technology [9] seems indispensable to make most of their benefits.

Fig. 3 Ekahau WLAN Tag [6]   Fig. 4 Aeroscout WLAN tag[7]

One important fact of hospital to maximize benefits such positioning solutions is position directly gives contexts. For example, Chow [10] attaches WLAN positioning tags on stretcher to track a patient goes into Operation Theater for safety management; the system tells whether right patient and right surgery staffs are in right theater. Additionally, the system submits SMS for registered patient's family members when the stretcher goes into / out from Operation Theater to ensure them the surgery finishes within estimated period. Chow claims the simple messaging system reduces quite a lot of tasks of clinical clerks to relieve constantly asking patient's family members.

Tracking can be also applicable for patients and clinical staffs. Most of such applications aim to keep eyes on dementia patient, although such attempts are not fully succeeded till now dew to basic human wants to be free from surveillance. Some attempts to track clinical staffs mainly for human resource management are undertaken. However, to convince staffs to be tracked by such positioning sensors, certain direct benefits, such as security support (panic button application) [11] or simply reducing login/logout process of HIS [12] should be introduced.

IV. SENSOR NETWORKING –REMOTE MANAGEMENT

Remote patient monitoring is another typical application. Including conventional Holter-type electrocardiogram, quite a lot of wireless monitoring devices are already in use in hospitals. And still several new devices such as wireless glucose meter [13] (Fig. 5), wireless artery thermometer [14], other vital signs, and even pain meter [15] (Fig. 6) are coming. Thus, main discussion about wireless monitoring system related research comes to how to avoid interferences among variety of wireless sensors and other wireless communication networks, which Criste [17] and other papers pointed out may occur. So, several researches to sensor network backbone using several wireless communication standards, such as WLAN, Bluetooth, Zig-Bee, UWB are under discussion. For example, Chandra-Sekaran et. al. [18] proposes self-organizing hospital area network WLAN and Zig-Bee.

Fig. 5 Roche Accu-Check Inform II [13]   Fig. 6 Wireless Pain Meter [16]

V. SUMMARY

This paper quickly browses snapshot of wireless hospital attempts. Overview gives an idea that key to open up next door toward wireless hospital future is to combine conventional medical IT technologies, incoming wireless technologies, and optimization of clinical process. Although this paper just browses intra-hospital wireless applications, application or trials for wireless technology in medicine have already spread out from hospitals. Along with regional/global electric health record attempt, literally wireless hospital can be emerged in near future.

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