

## An Architectural Design of Personal Gateway in Mobile Health-Care System Using Wireless Sensor Network

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### ABSTRACT

We present an architectural design of personal gateway in mobile healthcare system using wireless sensor network having three main components of wireless sensors, personal gateway, and database server in medical center. Individual wireless sensors monitor specific biomedical signals and communicate with personal gateway as a master and slave model. Home computer or Internet appliance can play a role of a personal gateway at home while a Personal Digital Assistant(PDA) or a smart phone does at outdoor environment. Personal gateway is configured for efficient data communication with wireless sensors. The Personal gateway is connected to database server in hospital through Internet or cellular network. And the personal gateway displays biomedical data locally and sends them to the database server periodically. Also a doctor in hospital sends prescription based on the recorded history of a patient and the database server gives proactive notice or takes an emergency action when a monitored biomedical data exceeds a preset threshold value. We also show the detailed design of medical protocol including detailed protocol state diagram, medical protocol format, and display-screen design.

### 1. Introduction

Ubiquitous computing and networking (UCN) is one of the major research issues for fore-coming information technology. Computing access will be anywhere, anytime, anydevice, anynetwork, and anyservice. One of the key field of UCN is wireless sensor networks that are formed by small nodes — tiny, self-contained, battery-powered computers with radio links that enable the nodes to self-organize into a network, communicate with each other and exchange data. A promising application area of wireless sensor network is a mobile healthcare system having “patient/doctor anywhere” concept [1]. Mobile healthcare system requires wireless sensor functionalities such as combined computational and networking capabilities, self-reconfigurability to join or leave at any time (i.e., plug and play).

Currently, there are many researches and development efforts in mobile health-care system. We summarize briefly the example models in the mobile healthcare system, shown in Table 1 and a main trend is personalized healthcare (e.g., telemedicine : E-health, E-care, E-medicine) with mobility either a patient is in home or anywhere.

An example in University of Alabama [2] is an implementation of wireless intelligent sensor based on a very low power consumption microcontroller and a DSP-based personal server on personal area network (PAN). Second implementation of TIISSAD project in France [3] monitors a patient at home remotely using an intelligent sensor module that reports patient’s condition to doctor and emergency center in three typical types of patients

such as elderly people, heart diseased patients, and kidney diseased patients. In order to monitor health conditions of solitary elderly people, Japan model [4] uses piezoelectric sensor system to inform an emergency via the voice modem or telephone to the patient’s family, an emergency center or a hospital.

Table 1. Research examples currently in health-care system[2][3][4]

Model Contents	Alabama model	TIISSAD model	Japan model
Wireless Network	0	0	X
Server / Client	0	X	0
Internet Connection	0	0	X
Multi-User	X	0	X
Plug & Play	X	X	X
Outdoor Possibility	X	X	X

As shown in features of each model in Table 1, these models focus on indoor environment and do not have plug-and-play function to give self-configuration of biomedical wireless sensors. Then we look forward to a mobile health-care system that is also convenient at outdoor situation, easily attachable and plug-and-play sensors, covers multiple users at home environment. This paper is to design a detailed architecture for mobile health-care system and to show basic system operation.

The rest of this paper is organized as follows. In section