The Maritime Telemedicine System Using a Satellite Communications Network

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Abstract. The telemedicine system is a system by which doctors in remote areas treat their patients based on their symptoms, information and bio-information to serve them best. The emergency medical services at sea consist mainly of the simple transfer of emergency patients using vessels such as those for first aid, which the maritime police used to provide without the concept of medical service. Thus, in this paper, the overall composition of the telemedicine system from the hardware and software aspects was examined, and the guidelines, through a web-based education system, and interface methods of medical equipment that can be linked with the system and the results of the linkage were examined to verify if it is actually helpful in medical treatment.

Keywords: Maritime telemedicine system, Satellite communications network, Web education system, Emergency center, Remote consultation system.

1 Introduction

The telemedicine system is a system by which doctors in remote areas treat their patients based on their symptoms, information and bio-information to serve them best. In this system, it is essential to select medical equipment that will suit the environment in the remote area and to link such equipment with the telemedicine system and data so that the medical specialist could decipher the state of the patient through the telemedicine system and clinical equipment and diagnose it correctly. The typical diagnostic equipment that can be linked with the telemedicine system are an electrocardiography measurement instrument, a digital stethoscope and a blood pressure monitoring instrument[1]. With these equipment, the condition of the patient can be assessed; but since the levels of the telemedicine equipment are inadequate for actually occurring diseases, the kinds of diseases that doctors can diagnose with them are minimal.

In the case of the emergency medical service system on land, since the enactment of the Emergency Medical Service Act in 1993 and its enforcement in 1995, the Emergency Medical Infrastructure Construction and the Pre-hospital Emergency Medical Service that is in charge of the National 119 Rescue Service of the National
Emergency Management Agency are in the stage of promoting qualitative take-off, advancement and acceleration. In contrast, the emergency medical services at sea consist mainly of the simple transfer of emergency patients using vessels such as those for first aid, which the maritime police used to provide without the concept of medical service. Moreover, at sea, it is difficult to quickly and properly provide first aid to injured and emergency patients caused by various incidents and accidents, so the initial measures are delayed, which threatens people’s lives. And the number of emergency cases at sea continues to increase yearly, thus maritime telemedicine emergency service model and the direction of the system should be presented, and the optimal countermeasures for emergency patients must be established[2].

In this paper, the overall composition of the telemedicine system from the hardware and software aspects was examined, and the guidelines, through a web-based education system, and interface methods of medical equipment that can be linked with the system and the results of the linkage were examined to verify if it is actually helpful in medical treatment. Moreover, the feasibility of linking the system with an actual hospital information system was examined by classifying the forms of data that can be linked to the equipment.

2 Related works

Recently, there have been many researches and technology developments on telemedicine on land, but their application at sea has been minimal. In general, when a medical emergency occurs on board a ship, the symptoms are conveyed by voice phone over the satellite phone installed in the ship to the 1339 emergency medical center of university hospitals, etc., and the prescription is received and the patient is treated. This kind of medical treatment not only incurs economic losses but is also very inefficient. To solve these problems, the INMARSAT[3] maritime satellite mobile communications service was proposed. The Inmarsat satellite mobile communications service that is used mainly in ships uses the global and spot beams of the Inmarsat third-generation satellite, and the telephone uses the existing Inmarsat mini-M resources satellite codec of 4.8 kbps whereas HSD (MISDN) uses the separate fleet channel. It is currently the most widely used terminal in large and medium-sized ships, and it provides a velocity of 64 kbps that allows communications to also be made through a TCP/IP network. Besides, there is the Bluetooth communication method, which has the advantages of being relatively safer than a wireless network given the security threats from wireless transmission, and of its frequency characteristics allowing signals to be transmitted in all directions so that specific angles need not be maintained to link with devices.

3 Proposed maritime Telemedicine System

Satellite communications and wireless mobile communications (HSDPA) can possibly provide Internet services at sea, but wireless mobile communications is possible only in coastal waters. The maritime police satellite network (KOSNET)
receives services from the KREASAT 5 relay station, which covers the Korean peninsula, Russia, Japan, the Philippines and part of China at an altitude of 35,800 km, and from communication between the district center on land, the coast earth station and the ship earth station. Thus, communication through a satellite network is considered effective, which is why this thesis attempted to build the system with it. Figure 1 shows a conceptual diagram of maritime remote paths. The telemedicine system transmits the patient information, bio-signals and symptoms in the sailing ship to remote hospitals and emergency medical centers through satellite communications.

![Conceptual Diagram](image)

**Fig 1. Proposed maritime Telemedicine System by Satellite Communications Network**

### 4 System implementation

A satellite communications system is made up of the satellite antenna, antenna control unit and satellite modem. In the ship’s telemedicine system, information on the medicines kept in the ship, patient information, medical histories and other necessary information can be extracted. Figure 2 shows the linking hardware of the ship’s telemedicine system, which is composed roughly of the satellite communications system, the telemedicine system and the linking equipment. To enable provision of medical treatment directions through a video, the communication bandwidth was set to make downloads and uploads more than 512 kb fast, and the telemedicine program for the maritime telemedicine system and a separate web-based education program were developed.
5 Conclusions

The medical team is seldom stationed in the ship to cope with cases of emergency patients needing medical treatment on the ship. In this case, if appropriate emergency measures are not taken, the patient’s condition will deteriorate and even his/her life can be threatened. In this thesis, to solve these problems, a maritime telemedicine system that utilizes a satellite communications network was designed and constructed, and the feasibility of linking it with diverse medical equipment was examined through a demonstration service to achieve a more effective support system. With the improvement of the system’s service quality, diverse improvements of its services such as the application of the information-system-based PHR, the specialization of the maritime telemedicine system, the establishment of emergency education and the construction of infrastructure will be continuously made.

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