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A Study on Development of a Home Health Care Support Information System

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Abstract

As the need for home health care has been increasing with the rising number of the elderly in Japan, the application of medical informatics to home health care delivery is considered to be useful. Therefore, development of a home health care support information system was planned. The system can collect patient's PHD (Personal Health Data) such as data of ECG, complaints, etc. at patient's home and can send the PHD to medical facilities. We designed and constructed two subsystems on a trial basis. One subsystem has function of gathering, recording and transmitting vital signs of the aged such as ECG, physical activity rate, oxygen saturation rate in arterial blood. Another subsystem can collect and send image data of the old people at their home. Experiments for trial use of the system was conducted and it was recognized that the PHD can be smoothly collected and recorded at home of the elderly and can be sent to the medical facilities with good success by using the system.

Keywords

Home Health Care Support Information System; Personal Health Data (PHD); Vital Sign; Image Data; the Elderly at Home;System for collecting, recording and transmitting PHD

Introduction

The need for home health care has been increasing with the rising number of aged people, increasing health care costs and insufficient medical manpower in Japan. The application of medical engineering or medical informatics to home health care delivery is considered to be useful in order to improve its level and give a means of solving the man power problem.

Therefore, we started to develope a home health care support information system in order to collect PHD (Personal Health Data) such as ECG data, blood pressure, complaints, symptoms, etc. at patient's home and to send them to medical facilities with a telephone line using ISDN for health evaluation and health control of the aged people including patients at home. In the present paper, the basic concept and design of the system and prototype of the part of the system for collecting vital signs and image data is described.

Materials and Methods

For the purpose of developing the system, we designed a subsystem for collecting and recording vital signs of the elderly such as ECG, heart rate, blood pressure, physical activity rate and oxygen saturation rate in arterial blood in the first place and manufactured a prototype of the subsystem on a trial basis.

A subsystem which can collect and record subjective or qualitative data such as complaints, symptoms, conditions, etc. of the elderly at home was also constructed by applying a multifunction telephone set called "Telemation" with an IC memory card. As a prototype of the subsystem was already reported at the MEDINFO 95 Conference [1], this subsystem is not described in the present paper.

Furthermore, we made a design and construction of a subsystem for collecting image data of the elderly with a digital still camera and a CCD camera. These data can be transmitted to the medical facilities of the physicians in attendance through ISDN.

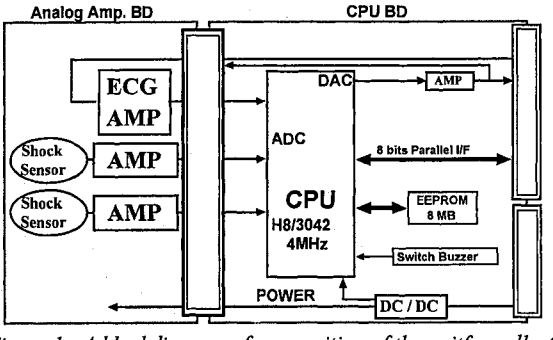

Figure 1 - A blockdiagram of composition of the unitfor collecting and recording ECG andphysical activity rate (AMX-24)

Results

Subsystem for collecting, recording and transmitting vital signs

We manufactured two units for the subsystem construction to collect and record vital signs. One unit can collect data of ECG and physical activity rate (This unit is named AMX-24). Con-

cerning ECG data, calculation of heart rate and detection of arrhythmias is performed by analyzing R-R intervals with a microprocessor. For this purpose, we made on a trial basis a new electorode for leading ECG which can be continuously and repeatedly used for long time (about one week). From the experiment of trial use of the electrode by cooperation of several volunteer old people, it was suggested that the electrode is suitable for continuous and long time use. Physical activity rate is measured by using two shock sensors. A blockdiagram of composition of the unit is shown in Figure 1. Figure 2 shows an appearance of a prototype of the unit. Its size is 118(H) x 64(W) x 23(D) mm and its weight is 150g.

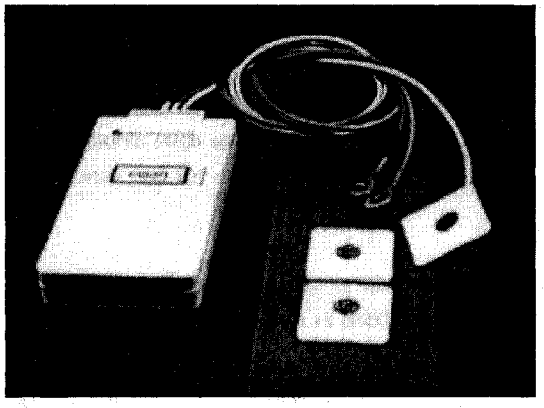

Figure 2 - An appearance of AMX-24

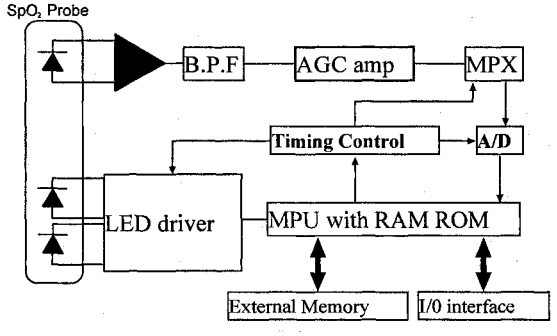

Figure 3 - A schematic diagram of the unit for collecting SpO2 data

The other unit can collect and record oxygen saturation rate in arterial blood by pulse-oximetry (SpO2 data). We planned to add a device for measuring blood pressure data to the unit. This device is, however, omitted at the beginning. Figure 3 shows a schematic diagram of the unit. An appearance of the unit is shown in Figure 4. Its size is 90(H) x 134(W) x 35(D) mm and weight is 250g.

Figure 5 shows a total concept of the subsystem for collecting, recording and transmitting vital signs. The subsystem does not prevent the daily life of the elderly because the vital sign data are lumped together and recorded in memory of data logger isolated from the elderly by telemetering or off-line data transmission with an IC memory card. The vital sign data can be sent to medical facilities by using the multifunction telephone set, "Telemation" or a personal computer. These data can be also transmitted from outdoors by using a portable telephoneSubsystem for image data collection and transmission.

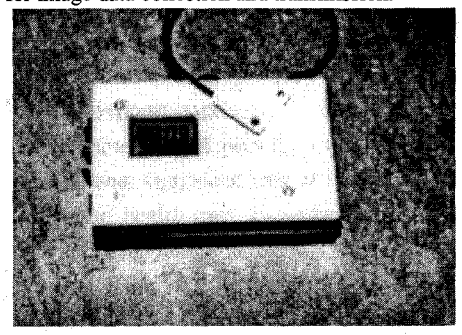

Figure 4 - An appearance of the unit for collecting SpO2 data

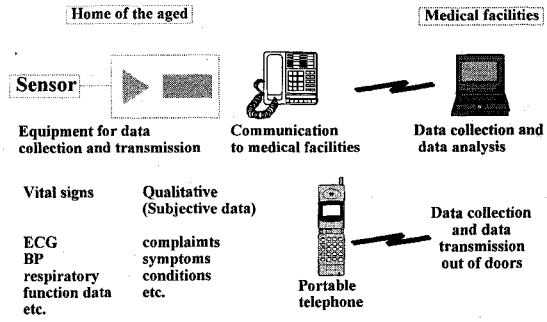

Figure 5 - A total concept of the subsystem for collecting, recording and transmitting vital sign data

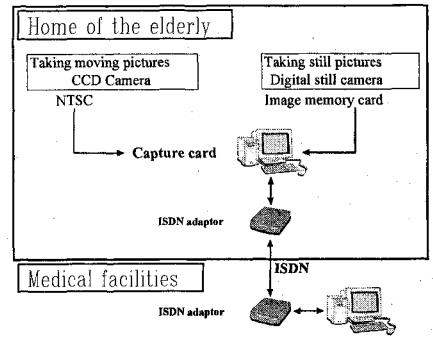

Figure 6 - Composition of the subsystem for collecting and transmitting image data

We planned also to develop a system for collecting still pictures such as a face, dermal lesion like decubitus, etc. and moving pictures such as movement of limbs of aged people at their home and for sending these pictures to medical facilities.

Composition of the subsystem is shown in Figure 6. In this subsystem, a CCD camera is used for taking pictures in motion and a still camera is used for still pictures which may need a good resolution. These pictures are transmitted to medical facilities through ISDN via a personal computer for data compression.

This subsystem has been just constructed and it is not used yet as a trial.

Discussion

In the present study, we designed a system to collect and record vital signs and image data of the elderly including patients at their home and to send them to medical facilities for supporting home health care. We also manufactured on a trial basis the prototype subsystem for collecting and recording ECG data, physical activity rate and oxygen saturation rate in arterial blood and tried the subsystem. Furthermore, a system for collecting still pictures and moving pictures of aged people at their home and for sending these pictures to medical facilities was composed.

In regard to monitoring vital signs for long time, we can already use some apparatuses such as a Holter electrocardiograph or a 24 hours blood pressure meter and these apparatuses are sometimes utilized for home health care. However, in case of using these apparatuses, it is difficult to obtain plural vital signs simultaneously with a single apparatus. Moreover, it is not suitable for the elderly to use these apparatuses at home owing to size and weight of them.

An apparatus by which data of ECG, blood pressure and physical activity rate can be simultaneously monitored was developed by us [2], [3]. This apparatus is, however, considered to be inappropriate for home health care, because it has problems that its size and weight is not suitable for aged user and it has not function of data transmission.

Therefore, we planned to develop the above-mentioned system which can not only gather and record several biological information but also transmit the information to medical facilities for grasping health condition of the aged at home.

The developed prototype subsystems for collecting vital signs don't have so high accuracy as biological instruments for clinical use. Its accuracy is, however, sufficient for home health care. By using the subsystem, aforementioned vital signs can be obtained without restraint.

We conducted experimental use of the subsystem by cooperation of volunteer aged people. From the results of the experiment, it was suggested that it might be useful for the support of home health care. However, the subsystem has a problem concerning size and weight of the portable unit of the subsystem from the standpoint of its users who are almost the elderly. That is, it is desirable that its size and weight becomes smaller and lighter by improvement.

On the other hand, with regard to the subsystem for gathering image data, it is expected that the subsystem is properly used depending on the kind of pictures, because it has function of collecting a still high resolution image and moving image. This subsystem has been, however, just constructed and it must be used as a trial as soon as possible in order to detect its problems from viewpoint of the support of home health care.

Conclusion

In the present study, a system for collecting, recording and transmitting vital signs and image data (PHD) of the elderly at home was developed in order to support home health care. Part of the system as a prototype was tried by cooperation of volunteer aged people.

The system is expected to be useful for the support of home health care although it has some problems such as size and weight. Hereafter, it is required that construction of the system is completed and trial use should be made more frequently for its practical use.

Acknowledgments

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References

[1] Ishikawa K, Sekita Y, Yamanaka T, Hosaka H and Inada H. An experimental study on home care support information construction. In:Greenes RA, Peterson HE and Protti DJ, eds. *MEDINFO 95*. Amsterdam:North-Holland, 1995;pp.615-619.

[2] Inada H, Horio H, Murakami M, Chiba Y, Sekita Y, Makikawa M, Sato S,Ishikawa K, Yoshida M and Furukawa T. A study on a home care support information system. *Med. & Biol. Eng. & Comput.*1991:29(Suppl): 952-952.

[3] Inada H, Horio H, Sekita Y, Ishikawa K and Yoshida M. A study on a home care support information system. In:Lun KC, Degoulet P, Plemme T and Rienhoff O, eds. *MEDINFO 92*. Amsterdam:North-Holland 1992;pp.349-353.

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