A Design and Implementation of U-health Diagnosis System using Expert System and Neural Network

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Abstract. Ubiquitous Health(U-Health) system witch focuses on automated applications that can provide healthcare to citizen anywhere/anytime using wired and wireless mobile technologies is becoming increasingly important. This system consists of a network system to collect data and a sensor module which measures pulse, blood pressure and so on. In this paper, we propose an expert system using back-propagation to support the diagnosis of citizens in U-Health system.

Keywords: Neural Network, U-Health, Expert System, Backpropagation

1 Introduction

U-Health system is inserted in the human body or wear a variety of possible bio-sensor signals through the human signal for a variety of real-time or periodic checks will be implemented automatically or manually. The human signal will be passed that to the system server that by using the Internet or wireless communication, regardless of time and space, through real-time communication network system. All data is passed to the results of an expert system to automatically real-time analysis of the materials inside to clean up problems that require a doctor's diagnosis in the final will be reported to a doctor. U-Health system is configured that to the new life you need to accurately monitor the development of a bio-sensor technology, measured bio-signals accurately in real time can be passed to medical institutions of networking technology, many of data to store, analyze the data processing and standardized systems and medical services provided to patients is composed of specialized medical services by using these materials. In this time the world's population being of the aging population to treat diseases of the human aspects of the disease than to minimize the possibility of extending life and health care for the senior population is an important element of health. Accordingly, concept of the ubiquitous home health care treatment such as the health care phone is accelerating the development of remote medical

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services medical services. U-Health system means in the biological signal instrumentation and automated diagnostics, emergency alert system means available in portable wireless biometric measurement. So developed in S.Korea products are using the mobile phone diabetes and blood sugar measurement, body fat diet with management and measurement of stress etc. U-Health systems related the country's leading research MobileWARD using the EPR(Electronic Patient Record) to check the status of each patient's room, store and manage data collected will be using the patient's condition. Collected of the sensing all data that room for a change of environment data and the patient's health status, stored in the database and sent to mobile devices will be monitored. UbiMon(Ubiquitous Monitoring Environment for Wearable and Implantable Sensors) is extracts from sensors attached to patient health information will be stored in the remote patient-database. Common and varies according to each individual and the importance of personalized health care system is increasing increase in because senior population and the increase in interest in health. It specially, ubiquitous computing environment be combined with the medical information systems for the diagnosis or prevent a variety of health-related application services are required. To do this, for the first time consisting of sensors to hardware and communications infrastructure must be built. The second, To need middleware technology to integrate the different hardware and communications infrastructure. And the third, it is based on the user interface module, health information collection and analysis, and a variety of applications for emergency response information service is required. But existing study has been active in progress focus on hardware infrastructure, such as sensors and devices. Therefore, U-Health System Application Service to build information systems management is focused on most of the work to improve the hospital's doctor or nurse and the patient's disease. More and more focus on the health of individuals increased demand for health care information services studies are underway for the privacy personalized U-Health system actively. In this paper, U-Health systems research is for the Expert System. So Using Expert System to the results of analysis and decided that for the purpose of developing a system to transfer the data from sensors and a thorough examination it obtained from the hospital database.

2 System composition and design

U-Health system is composed of Bio Sensor Device, Bio-DB Server, Standard-DB Server and Expert System. Fig. 1 is the entire system configuration. Bio-sensors can detect the device is optionally that recognition for a particular substance is a biological receptor is combined with an electric or optical transducer response to biological interactions and recognition to convert to electric or optical signals to analyze the material. Detect biological signals go by way of Wireless Network for the Detection of life will be passed to the database server.

Fig.1. System composition

It was implemented to Zigbee wireless sensor network in the 2.4GHz system. Fig. 2 is the Zigbee-based wireless communications screen.

Fig.2. Zigbee-based wireless communications screen

Table 1 of the sensing data stored temporarily in the Bio-DB is the structure of the incoming data. The data from the actual pulse data, measured by the sensor value

Table 1. The structure of the sensing data .

7E 00 0A 7D 10 00 00 02 00 00 00 01 00 02 00 EE D3 FF FF 55 00										
1	2	3	4	5	6	7	8	9	10	11
7E 00	0A	7D	10	00 00	02 00	00 00	01 00	02 00	EE D3 FF FF	55 00
1.Address 2:MSG Type 3:GroupID 4:Data Length 5:Source address 6:Orgin address 7:Sequence number 8:Hop Count 9:address 10:timestamp 11:reading										

2.1 Expert System

Expert systems divide into two classes that topic field of Expert knowledge (computer program means the information necessary to act intelligently) knowledge base to store and the solution topic to save on general knowledge, reasoning engine.

Expert system structure compose knowledge base module, inference engine module and user interface module fig 3.

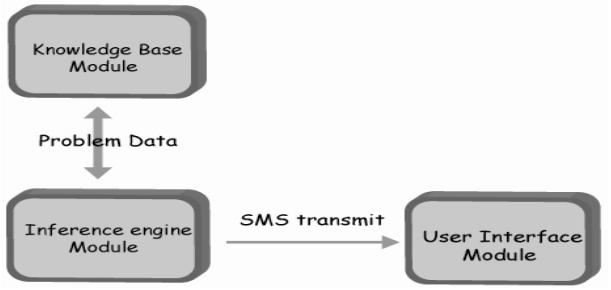

Fig.3. Expert system block diagram

2.2 The medical diagnosis system which uses Backpropagation algorithm

The input comes weight of the neural network to double and when some time repeats the process which becomes worse the output(y) which is a resultant price of input comes out. The output(y) given in the study data, the desired output(o) and is quite different. As a result, the neural network (y-o) as a margin of error (e = y-o) when the error weight in proportion to the renewal of the output layer, and then update the weight of hidden layer. Weight to renew the opposite direction, the direction is the direction of the handling of the neural network. As Backpropagation algorithm does with like this reason. Says again, the control of the neural network is advanced with direction of input layer → hidden layer → output layer, the studying direction of weight renewal is advanced at output layer → hidden layer. Uses the incoming data 4 comes to give and 4 phased neural network composition lower part and is same.

Table 2. proposed. Backpropagation algorithm

Number of the data for studying : N ith (1≦i≦N) studying data set : I_i I_{i1} : The contraction blood pressure Rate I_{i2} : The relaxation blood pressure Rate I_{i3}: Breathing Rate I_{i4}: Pulse Rate

① Input layer possibility of node must be 4 is a number of each data item.

② Output layer dangerous degree have the node 4. If incoming data leads and when in compliance with Weight where is studied the 1st node is selected, corresponds to level 1 shows a normal shame.

③ Possibility of node of hidden layer 1 or does above of that. The time of studying where the number of hidden layer comes to be many increases deciding the number of the hidden layer which is proper are important.

④ Standardization in the input data to obtain the maximum and minimum value.

3 Experimental result and evaluation

The territory where embodies from user web monitoring system the user connects in the Webpage and when selects health information, will connect with a normalization database and pulse, the blood pressure and body mass index of person oneself, there will be expert system will lead and a possibility the monitor of doing blood glucose etc. bio information shame and there is a possibility which a judgment result the monitor will do. After embodying the user web monitoring system with state information is a screen which outputs a judgment result about resultant value of pulse, the contraction blood pressure, the relaxation blood pressure, body mass index, the empty stomach shame, two hours after the blood glucose of the user who is stored in user_info tables of normalization database server Fig 4.

Fig.4. Resultant screen of healthy information

The expert monitoring system the expert drove sensing data information and the monitoring to do under feedback normalization database server and specialist system was linked and embodied. In the counter and the number which is every was the per minute new data added in normalization database to confirm and if newly the sensing data is, will be able to judge from expert system in order, checks per minute at unit. Judgment result and data the monitoring is a screen which does about automatic prosecuting attorney item of user Fig 5.

Fig.5. Judgment result of automatic prosecuting attorney item

When the normalization database server and expert system server are linked and the bio data of the user arrives to risk level, SMS functions will lead and the letter message could be transmitted with automatic and makes embody. Uses the timer and when there is a data which is new per minute at unit is a inference result to send a judgment result Fig 6.

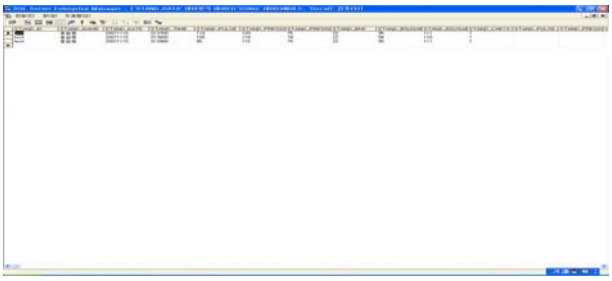

Fig.6. Inference result

The data structure make inference and transmits a SMS from under WIPI environments the example which shows Fig 7.

Fig.7. SMS transmission results

4 Performance Evaluation of System

In order to test the system which is embodied from the sensor pulse rate possibility 200 acquires, the contraction blood pressure and the relaxation blood pressure, breath

rate used an bio signal. Also each data according to diagnosis of the expert classified with 4 kind conditions. Show the bio signal by condition of the user Table 3.

Table 3. Bio signal condition of user

Level	Pulse	Breath	contraction blood pressure	relaxation blood pressure
	Unit : Count	Unit : Count	Unit: mmhg	Unit: mmhg
Level.1	60-90	12-20	100-130	60-80
Level.2	91-140	21-29	131-149	80-90
Level.3	141-180	30-34	150-180	90-100
Level.4	180 over	35 over	200 over	100 over

From the sensor from 1st data in data 200(EA) acquires the 100th data used in running and from 101st data the 200th data used in evaluation. The data 100(EA) are used in running passed by a normalization and pulse rate(HR), the contraction blood pressure and the relaxation blood pressure, used from the expert used day three of breath rate(BR) with input and from the expert used the diagnosis result which comes to get at target value. Data 100(EA) led and weight after running, from remaining 101 times from 0 normalized input the data until of 200 times at price between of 1.
A result is an expert system of running Table 4.

Table 4. The system judgment result which is used in evaluation

No	Pulse	Breath	contraction blood pressure	relaxation blood pressure	Diagnosis Result of Doctor	Diagnosis Result of System
	Unit : Count	Unit : Count	Unit: mmhg	Unit: mmhg		
101	128	32	167	93	Level.3	Level.4(*)
145	88	18	122	79	Level.2	Level.3(*)
151	96	21	133	89	Level.1	Level.2(*)
180	81	15	121	77	Level.1	Level.2(*)

* :Diagnosis result of the specialist and to indicate that the result which presents from the this paper comes out being different.

4 results in total 100 valuation dates came out being different, they were visible about 96% accuracy. Also the result from of expert system did not occur diagnosis result of the specialist more low-end case in case the problem could occur.

5 Conclusion

Currently with strong point of the system which is planned does not woo in place and time not to be and the bio information measurement and data communication possibility are is a strong point. In addition, judgment result immediately with the monitor ring box will be able to perceive a dangerous situation immediately.

Prevented the overhead in 3-tier in compliance with the system design of method systems and specialist monitor ring system led and with hospital data base gearing easily did. In order to evaluate the efficiency of specialist system from the sensor pulse rate 200 acquires(HR), used the contraction blood pressure, the relaxation blood pressure and the bio signal of breath rate(BR) etc. 4 kind. From the sensor from 1st data in data 200 acquires the 100th data used in studying and from 101st data the 200th data used in evaluation and 4 results in the resultant total 100 valuation dates which evaluate efficiency came out being different, they were visible about 96% accuracy. Also on a large scale the case the problem could occur, the result from of namely specialist system did not occur a diagnosis result of the specialist more low-end case. Specialist system the diagnosis result and specialist monitoring system of one system delivers the data which is more accurate in the diagnosis which the existing medical attendance is subjective with will be able to prevent an error in base. And initially diagnosis of the high hazard group patient and an emergency situation quickly and in dangerous condition of the patient the monitoring which is continuous leads and recognizes appropriately, disposes with will be able to prevent a dangerous situation beforehand. Currently the sensor which attaches in the body leads and are measuring the bio signal of the user this on period of measurement to give a disruption to the life which is ordinary, inconveniently, becomes. Simply will be able to attach consequently in the body user oneself is inconvenient from daily life cannot feel about the bio signal measurement sensor of the degree research came to be more and, judges with the fact that the system which improves a little more will become performed. To hereafter diagnosis result will develop the algorithm will be able to predict the strength which is various with base the efficiency of specialist system with the knowledge base construction which is various to improve and miniaturization of the bio sensor, the pressure sensors and GPS bases moving/strength tracks etc. uses the groove network system embodiment which uses a location grasp function and the radio sensor and a statistical algorithm a system to lead and in order to improve.

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