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A Study on the Mobile Device using an Environmental Information–Collecting Sensor

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Abstract

Objectives: This paper aims to enable the convenient health management of elders and to inform the time of activity. **Methods/Statistical Analysis**: To measure the precise environmental information of the peripheral areas of the elders' residence, not in the weather center faraway, the sensor is installed to detect fine dust, temperature and humidity. The sensor is installed not for individuals but for the welfare institution to be managed and the environmental information values collected in the welfare institution are transferred to each user Tab. The goal of this study is to enable the elders to live conveniently and to obtain accurate values. **Findings:** The service proposed in this study is a health keeper service that can provide safety as well as health management to the elders. It is a service where the welfare institution (administrator) consults with the users to enable systematic management according to the collected information and consultation contents and it is a safety and health management system that collects the outside activity value of the user through the environmental data value of the user's region and through the device. The mobile health monitoring system proposed in this study aims not to provide emergency care to a user in a specific space, but to quickly inform about an emergency situation in any space. The system proposed in this study uses a mobile device, which is a small device that can be carried with the smartphone. The mobile device has the advantages of reducing the sense of alienation that the socially vulnerable class feels by providing companion helper service and of preventing social problems through conversation with the volunteer or the guardian. **Application/Improvements:** The health information of the middle-aged class can be collected to be utilized in a Big Data form and can be induced to enable active management through real-time feedback.

Keywords: Consultation, Environmental Information, Mobile Device, Safety, Sensor

1. Introduction

Due to the development of medical technology, improvement in the standard of living and decrease in birth rate, Korea is becoming "the country getting old the most quickly". As large family structures are gradually changing into nuclear family structures, the elders who played the central role in the family are no longer playing supportive roles or are even being neglected[1]. Due to these environmental changes, the elders have become vulnerable to mental illnesses, such as depression, but it is difficult to think that depression during old age is a natural phenomenon. According to a survey, 1 of 10 elders aged 65 were shown to experience depression that requires treatment[2]. (Figure 1).

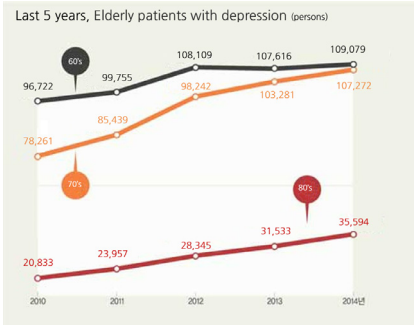

Figure 1 Number of elderly patients experiencing depression.

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There is a study result that most elderly patients with depressive disorder are suffering from vascular depression due to Cerebral Blood Flow (CBF) circulatory disturbance. High-risk groups, such as those with stroke and hypertension, are working on aerobic exercises, such as regular walking, to prevent these problems in Table 1.

Table 1. Comparison of the main depressive disorders of elders

Age range (years)	Prevalence rate of depressive disorders	
	Vascular depression rate (%)	Nonvascular depression rate (%)
65–69	33.3	66.7
70–74	75	25
75–79	100	0
80 and above	100	0

2. Mobile Home Care Service

u-Care System is composed of a physical layer that collects indoor environmental information through the temperature and humidity sensor in the residential environments of elders living alone, such as silver apartments and collects the movement direction, current location and use information of the electronic devices through the activity detection sensor, door sensor and on/off switch; a situational awareness layer that supports communication between the physical layer and the application layer as well as recognizes the collected information as situational information per use in real-time; and an application layer that supports location information and situational information provision through web services and applications that support text message transmission to the guardians' mobile phone on alarm[3]. The physical layer collects temperature and humidity information through the USN-based environmental sensor that exists inside the house of an elder who lives alone and also collects indoor movement information through the activity detection sensor connected to the I/O sensor board, door open detection sensor and on/off switch to be provided [4–6].

The system proposed in this study uses a mobile device, which is a small device that can be carried with the smartphone. The mobile device has the advantages of reducing the sense of alienation that the socially vulnerable class feels by providing companion helper service and of preventing social problems through conversation with the volunteer or the guardian. Moreover, for the social welfare organization to check the health and environmental conditions of the socially vulnerable class, systematic management is possible. Especially, but quickly identifying the emergency of the user based on the health condition and environmental condition, efficient home healthcare service can be provided in the aging period.

In the mobile device, a sensor, a module, Bluetooth, an acceleration sensor (step count) and a speaker are mounted. When the "outdoor mode" is set on the Tab, that is, when the user is not inside the house, the mobile device is turned on and at the same time, the environmental information value stored in the Tab are transmitted to the device. When the outdoor mode setting is complete and the number of steps and the time of the elder are measured and when a specific pattern is inputted or a button is clicked, the SOS function is turned on. In the outdoor mode, the SOS function is a service that requests help from people around through a speaker installed inside the device.

Lastly, when the outdoor mode is finished, the data measured by the device is transferred through the network to the user's Tab and at the same time, the data recorded on the device is initialized to finish the outdoor mode.

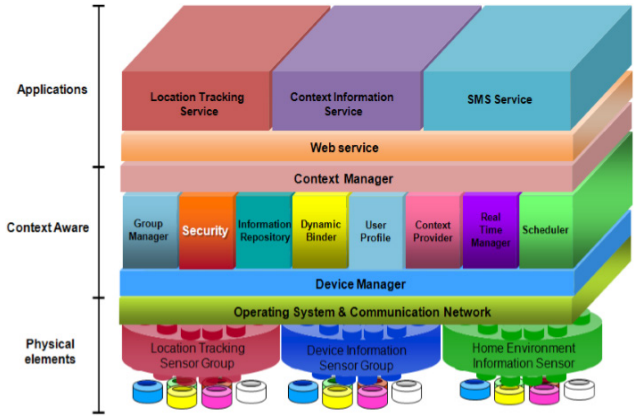

Figure 2. Sensor, devices, information, their groups.

The purpose of computing situational awareness is to collect data on the user's movement and environment to enable the computer to recognize and take the desired action. The process of providing various information or service related to the user's work is called "situational awareness system". As part of the home health care service, the mobile device is mounted to collect data and the

collected data are used to classify the general situational information into the user's situation, physical environment situation, computing system situation and other unclassified situations to extract the desired data[7,8]. (Figure 2).

3. Environmental Information-Collecting Sensor

For the precise measurement value of the area covered by a user's movement, not the regional information provided by the weather center, the sensor is installed and fine dust, temperature and humidity are detected.

```
// Code to indicate the temperature and humidity
measurement data value on top of the main screen in real
time.
void OnTitleView(CDialog* pDlg).
{
        CString strMsg;
        strMsg.Format("Temperature:%.0f℃", theApp.m_
dbTemp);
        pDlg->SetDlgItemText(IDC_STATIC_TEMP,
strMsg);
        strMsg.Format("Humidity:%.0f%", theApp.m_
dbHumi);
        pDlg->SetDlgItemText(IDC_STATIC_HUD,
strMsg);
   strMsg.Format("%s [%s]", theApp.m_sUserStatus.
strName,
GetStatusStr(theApp.m_sUserStatus.sStatus.nStatus));
        pDlg->SetDlgItemText(IDC_STATIC_USER_
STATUS, strMsg);
}
```

A video phone service with the counselor of the welfare institution or with other users using the same service is provided. Moreover, for emergencies, a one-touch SOS message transmission service is provided to the counselor and the user's regional environmental information is collected through the sensor to be shown and health care is possible through the pace counter and pulse measurement. This health care function can be utilized more through comparison with other users. Also, the user can check the alarm for cold wave or heat wave when outside. Furthermore, the security service of converting the Tab to the "Outdoor Mode" when the elder goes out and informing about the situation when human movement is detected was realized [9].

The purpose of the security service function is to send an SOS message when human movement is not detected for a certain period to detect the death of elders living alone. Through a video call with the user, consultation is performed periodically and the counselor can check recent call details, consultation history and the health data chart value measured through the health keeper. Moreover, after the consultation, the counselor can measure the contents of the consultation and the health information and combine the information to input a subjective opinion about the mood of the user. The user can then be classified whether he/she requires consultation. Furthermore, the counselor can check the list of users that did not have consultation for a long period or users who are classified as requiring management after the consultation to put utmost priority to the performance of the consultation[10–12].

4. Proposal System

The health care system using the environmental information–collecting sensor proposed in this study is a health keeper service that provides customized information based on the regional environmental data collected by using the sensor[13], as well as safety and health care to the user by collecting data on outdoor activity through the device or through the SOS function, which requests help from people around during an emergency. (Figure 3).

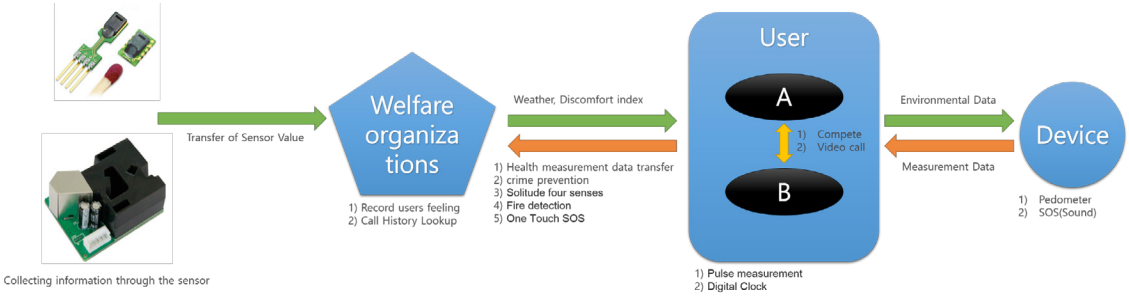

Figure 3. Overview diagram.

4.1 User Program

In the user program, the companion helper function is provided in the Tab application and video call is possible with the counselor or between the users. The companion helper function is one of the key parts in this technology development and the parts of the codes realized are shown as follows:

```
// Video call function code
        CString strMsg;
        strMsg.Format(«Will you call the counselor[%s]?»,
m_sCounseller.strName);
//      if( AfxMessageBox(strMsg, MB_YESNO) ==
IDNO)
//              return;
        CString strWhere;
        strWhere.Format(«where UserID='%s'»,
theApp.m_strID);
        theApp.m_sUserStatus.sStatus.nStatus = USER_
STATUS_PUT_C;
        if( !m_pAdoUse->EditUserStatus(theApp.m_
sUserStatus.sStatus, strWhere))
        {
        AfxMessageBox(m_pAdoUse->m_strLastError);
        return;
        }
        CCallViewDialog dlg;        // Show video call
screen
        m_sCounseller.sStatus.strCallerID = theApp.m_
strID;
        dlg.m_pAdoUse = m_pAdoUse;
        dlg.SetPutCall(m_sCounseller);
        dlg.DoModal();              // Proceed video call
```

The one-touch SOS message transmission function is to touch the button on the Tab or to turn on the SOS function to prepare sending an SOS message to the counselor and the guardian. The camera can be opened to take a picture of the current situation, which can be sent along with the SOS message.

In the user program, the health keeper service measures the user's pulse by using a pulse sensor and the welfare institution analyzes the environmental information data received to provide customized consultation on matters for caution and for reference. The amount of activity (number of steps and time) collected through the mobile device and the pulse measurement result collected through the Tab can be shown in a graph and the amount of daily activity between users can be compared to create competition and motivation for steady health care.

For the 24-hr. risk detection system, in case of fire, the temperature sensor on the Tab classifies it as fire when the temperature is higher than 50°C and requests SOS service. Moreover, the function for preventing the death of elders living alone uses the human detection sensor to request SOS service when the user is not moving for 24 hr. When converting to the outdoor mode, this function is changed to the security function.

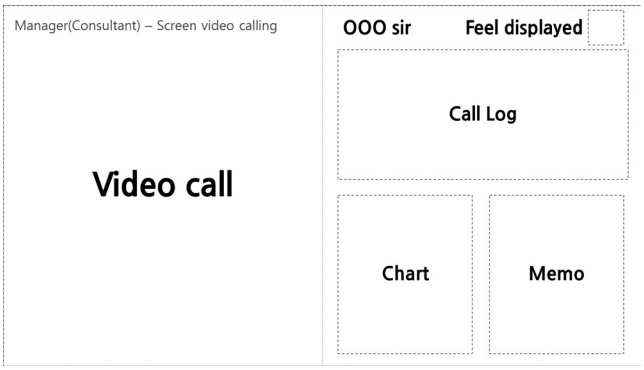

Figure 4. Administrator_ counselor screen.

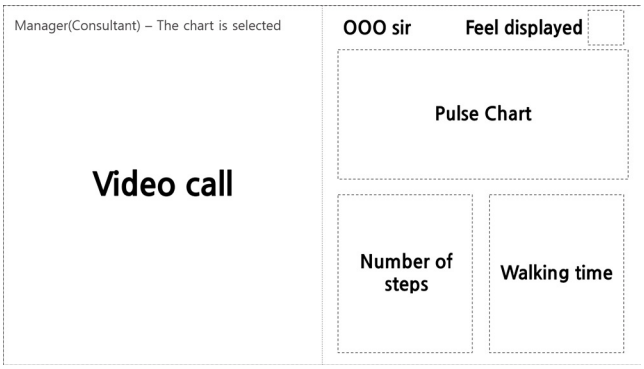

Figure 5. When selecting the chart in the administrator_ counselor screen.

4.2 Administrator Program

The purpose of the administrator program is to quickly identify an emergency based on the periodic consultation with the user through a video call service to take action. Normally, periodic consultation with the user can be performed and during consultation, the counselor can check the health information collected on the user Tab and record any remarks. After the consultation is finished, the counselor can register the subjective opinion on the user's condition by selecting among "happy", "mad" and "depressed" to record his/her condition. The consultation details of each user can be checked and the list of users

who did not have consultation for a long period can be checked to perform the consultation. Moreover, the availability for a video call can be checked before making a call. (Figures 4 and 5).

4.3 Emergency Program

When the user is in an emergency situation, the SOS button can be pressed to conveniently request to call the counselor or the volunteer and if a call has never been made before, it provides a UI of the list to the counselor or the volunteer to attempt making a call. For the video call service, the operation service used by the counselor and the volunteer is registered with at least one user information and the stored information includes not only personal information and health information, but also information on the location and the guardian.

5. Conclusion

The mobile health monitoring system proposed in this study aims not to provide emergency care to a user in a specific space, but to quickly inform about an emergency situation in any space. Therefore, continuous study is required on reducing the time required for the process of identifying the location of an emergency and sending an SOS message. Moreover, other than temperature and heartbeat sensors, various methods to recognize physical information and external environment must be found to gradually expand the possible range of care that can be provided. Through this health care, the illness prevention effect and the medical cost reduction effect will be shown and user convenience will be maximized through automatic management. Furthermore, the product based on this technology will reduce the development time, which will lead to price reduction and competitiveness. Moreover, the health information of the middle-aged class can be collected to be utilized in a Big Data form and can be induced to enable active management through real-time feedback.

6. Acknowledgment

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7. References

1. Park CY, Im H, Park S, Kim SH. Technical trend of u-health language table. Self-communication Trend Analysis Book. 2010 Aug; 25(4):48–59.
2. Korean National Statistical Office. Annual Report on the Statistics for the Elderly; 2010.
3. Priyantha NB, Miu AKL, Balakrishnan H, Teller S. The cricket compass for context-aware mobile applications. Proceedings of the 6th Annual International Conference on Mobile Computing and Networking; 2001 Jul. p. 1–14.
4. Joo SJ, Kim NK, Jang JH. Indoor location tracking method and system. Patent registered in the Korean Intellectual Property Office, (Registration No.: 10-0707146); 2007 Apr 6.
5. Shin CS, Kang MS, Jeong CW, Joo SC. TMO-based object group framework for supporting distributed object management and real-time services. Lecture Notes in Computer Science. 2003 Sept; 2834:525–35.
6. Lee CS, Yoon YM, Jung CW, Joo SJ. Heterogeneous sensor information construction and management for healthcare home service. Korea Information Science Society Journal. 2006 Oct; 33(2A):210–3.
7. Dey AK. Understanding and using context. Personal and Ubiquitous Computing Journal. 2001; 5(1):4–7.
8. AWARENESS Service Infrastructure D2.1. Architectural Specification of the Service Infrastructure. 2004. Available from: https://doc.telin.n1/dscgi/ds.py/Get/File-49225/D2.1_-_Awareness _Service_Infrastructure.pdf
9. Son MS. Wearable system for u-health service support. Electronic Communication Trend Analysis Book; 2006 Sept.
10. Sowa JF, Zachman JA. Extending and formalizing the framework for information systems architecture. IBM Systems Journal.1992; 31(3):590–616.
11. Thomas G, Gunning K. Introducing a nationally shared electronic patient record: Case study comparison of Scotland, England, Wales and Northern Ireland. International Journal of Medical Informatics; 2013. p. 125–38.
12. Koteeswaran S, Srinivasan R, Varunkumar KA. Region specific election routing protocol for Wireless Sensor Networks. Indian Journal of Science and Technology. 2014 Dec; 7(12):2083–7.
13. Vinothini M, Umamakeswari A. Reliable data transmission using efficient neighbor coverage routing protocol in Wireless Sensor Network. Indian Journal of Science and Technology. 2014; 7(12):2118–23.