

## Development of Digital Pen Image Data Entry System to Support Outpatient Electronic Medical Record

Nam-Hyun Kim<sup>1</sup>, Hae-Ran Lee<sup>2</sup>, Byung-Chul Chang<sup>3</sup>, Sun-Kook Yoo<sup>4</sup>

<sup>1</sup>Dept. of Biomedical Engineering, College of Medicine, Yonsei University

<sup>2</sup>SoftNet Corporation, Seoul <sup>3</sup>Dept. of Cardiovascular Surgery, Yonsei Univ. College of Medicine

<sup>4</sup>Dept. of Medical Engineering, Yonsei Univ. College of Medicine, Center for Emergency Medical Informatics

### = Abstract =

Recently, several hospitals have changed their systems from legacy system to electronic medical record (EMR) system for inpatient and outpatient. There are several obstacles to this change such as user resistance; expense of education, time spent due to entering data, and etc. So there is a significant need for various, easy and user-friendly data entry system for collecting electronic medical record. The purpose of this study is to develop the electronic data entry system using digital pen to support outpatient treatment rapidly. Especially the memorandum paper product and dental outpatient paper product are implemented to get drawings and questionnaire data effectively. Digital pen can quickly and easily capture everything the user writes. Digital pen data entry system is not only good method to save image quickly but also useful to digitalize the questionnaire items (check boxes, numbers) by using text recognition engine. Therefore, we expect the electronic data entry system using digital pens can be the helpful and the easiest migration tool in successful adaptation of the EMR.

**Key words:** Electronic Data Entry System, Image, Digital pen, Electronic Medical Record, Digitalized Data

1.

(EMR)

가 가

가

: , (120 - 752)

134

EMR

[5 - 8].

가

[1 - 3].

(2003)

Feldon(2002) Steven E PC 가 가

[2, 4].

EMR

가

EMR

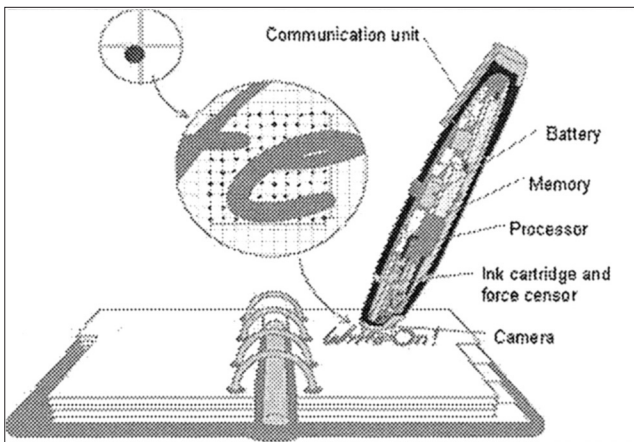


Fig. 1. Pattern and Digital pen

2.

### 2. 1. Anoto Functionality

Anoto functionality Anoto 가

(Fig. 1).

Anoto

가

0.3 mm<sup>2</sup>

100 μm

mm

4가

0.3

가

가

2 (bit)

[9].

Anoto Functionality

가

EMR

. Cherokee Indian Hospital( )  
 , Anthem Blue Cross and  
 Blue Shield (BCBS, ) , Hô  
 pitaux Universitaires de Geneve(HUG, )  
 가, 가  
 Royal Ottawa Healthcare Group( )  
 , Solna( )  
 )

**Table 1.** Paper Application Definition file

```

<pages>
<!-- Generated 8/22/05, 7:32:36 AM by QuarkXPressTM 4.1 [4.1] and GDT 1.0 r2 -->
  <application_info name="service" value="Sofnet::Dental"/>
  <application_info name="pattern_page_type" value="copied"/>
  <application_info name="char-height" value="21"/>
  <application_info name="char-width" value="14"/>
  <application_info name="page_num" value="1"/>
  <application_info name="page_category" value="none"/>
  <page address="35.0.1.35">
    .....
    <drawing_area top="32" left="32" name="Drawing Area" width="733"
height="1035">
    <user_area top="188" left="68" name="big" width="658" height="784"/>
    <user_area top="62" left="81" name="small" width="261" height="124"/>
    .....
  
```

가

EMR

EMR

가

가

2.2.

Logitech io pen

&

Anoto

Anoto FDK(Form Development Toolkit)

Anoto SDK(Software Development

Toolkit)

Visual

가

C#.NET

Microsoft.NET

Framework version 1.1

Windows XP

:

Anoto

( )SoftNet DigitalPen.

Recognize

Anoto SDK version 1.0

PAD(Paper Application Definition

Database

Microsoft

Access Database

file) PS(Postscript)

: PAD

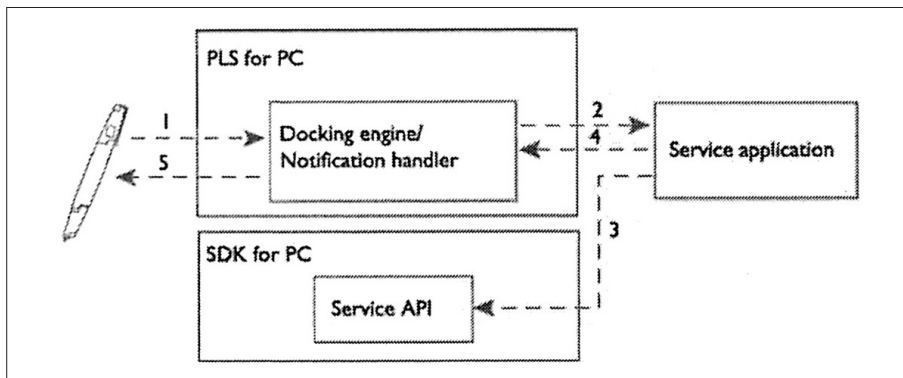
XML

가

2.3.

(Table1).

Pen API Service API



**Fig. 2.** Performance of data synchronizing process

Application : 가 1pt, 3pt, 6pt 가, Notification handler 가 loading , B5 , 가 (Fig. 2). 가 Postscript : temp Jpg , 1200DPI (Table 2), , EMR ( ) (Fig. 3).

3. 3.2. 가 3.1.

Table 2.

```
// Create Pen having same color and linewidth as Anoto pen
pen = new Pen(Color.FromArgb((int)red,(int)green,(int)blue), Convert.ToSingle(pStroke.lineWidth));
// Draw line between each point in PenStroke.
for(j=0; j<x.Length-1; j++)
{
    g.DrawLine(pen, (Convert.ToSingle(x[j]))/DRAWSCALE, Convert.ToSingle((float)y[j]-topY))/DRAWSCALE,
    (Convert.ToSingle(x[j+1]))/DRAWSCALE, (Convert.ToSingle((float)y[j+1]-topY))/DRAWSCALE);
}
if(playing)
    Page.Refresh();
}
```

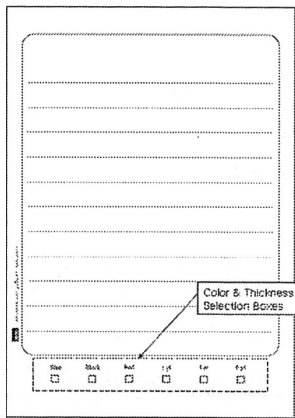
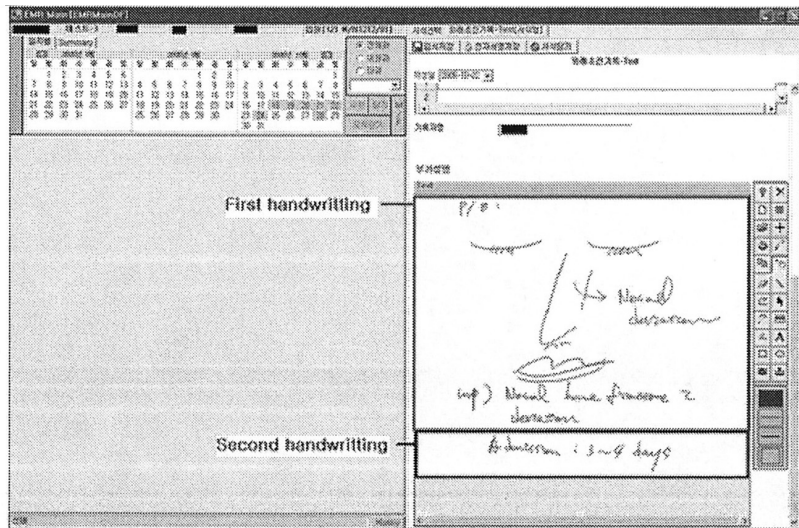


Fig. 3. EMR



( )

가 2-5, (Fig. 4). 가 EMR 가 text (user area) Database 가 PAD 4. 가 (Fig. 4, 5). Active X PC 2-4, ( )SoftNet 가 80% EMR (department) 가



Fig. 4.

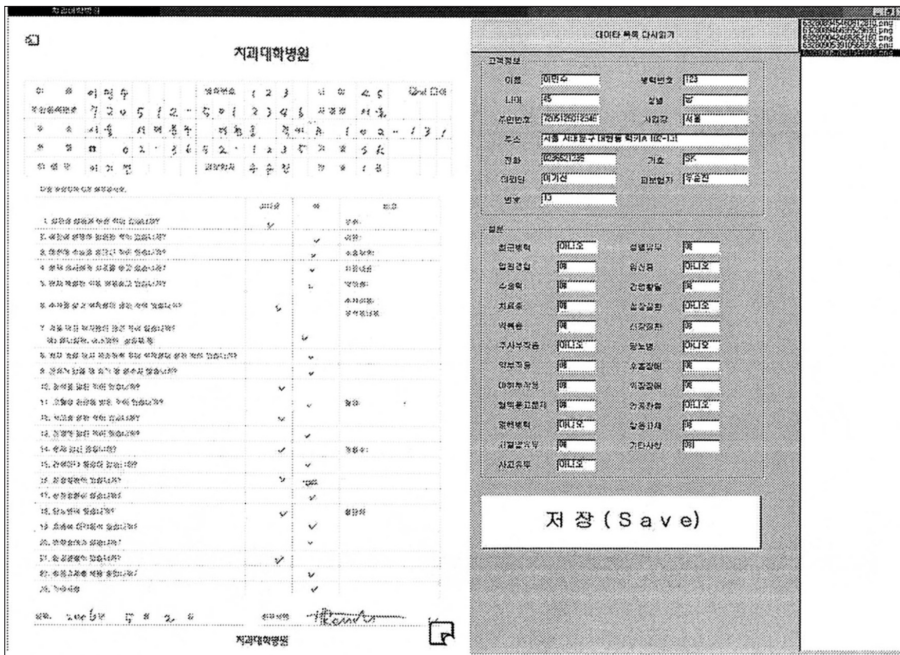


Fig. 5.

EMR

가 adaptation tool

Acknowledgments

- \* . ( : A040032)
- \* . ( : A060677)

1. The Expecting effect and forecasting of EMR. Available at <http://humc.hallym.or.kr/med-info/emr.htm>
2. Steven E Feldon, H Jay Wisnicki, "Electronic medical records still represent the wave of the future", Ophthalmology Times, Vol. 27, Iss. 9, p. 42, 2002

EMR 가

3. Jeong-Wook Seo, Kyung Hwan Kim, Jin Wook Choi, Kyoo-Seob Ha, Ho Jun Chin, Jong-Uk Kim, Suk Wha Kim, Jung-Gi Im, Suhnggwon Kim. "Implementation of Electronic Medical Records at Seoul National University Hospital", J Kor Soc Med Informatics, 12(3):213-225, 2006
4. Nackchin Sung, "Electronic Medical Record of Ambulatory Care Settings in Korea", The DongGuk Journal of Medicine 10(1):1-12, 2003
5. Elodia Cole, Etta D. Pisano, Gregory J. Clary, Donglin Zeng, Marcia Koomen, Cherie M. Kuzmiak, Bo Kyoung Seo, Yeonhee Lee, Dag Pavic. " A comparative study of mobile electronic data entry systems for clinical trials data collection, "Int J Med Inform, Dec 27 [Epub ahead of print], 2005
6. Briggs, B. Digital technology puts pen to computer. Health Data Management, 12(10), 94, 96, 2004
7. Schiavenato, M, " Technology Brief: Digital Pen and Paper: A review of the technology and its potential application in healthcare, "Online Journal of Nursing Informatics (OJNI), 10, (1) [Online]. Available at [http://www.eaa-knowledge.com/ojni/ni/10\\_1/schiavenato.htm](http://www.eaa-knowledge.com/ojni/ni/10_1/schiavenato.htm)
8. Partner Press release : BartCharts and PSR Announce the Introduction of eBC. Available at <http://www.anotogroup.com/cldoc/15983.htm>
9. Anoto Functionality. Available at <http://www.anotofunctionality.com>

