韓國 컴퓨터情報學會 論文誌
第12卷 第2號, 2007. 5.

2007-12-2-3-4

RFID와 UCI 기반의 URN을 활용한 SPMR 설계

장 덕 성*

Design of SPMR using URN based UCI with RFID

Doc-Sung Jang*

요 약

환자의 의무 기록을 전국적으로 연결하는 것은 환자의 정확한 정보를 취득하여 의사로 하여금 환자의 증상을 정확히 진단할 때 중요한 사항이다. 환자에 대한 진단 시 시간과 재검사 시간을 줄일 수 있다면, 환자는 신속히 치료될 수가 있기 때문에 모든 국민은 그만큼 더 삶의 질을 높일 수 있을 것이다. 본 연구는 RFID 카드와 디지털화된 의료기록간 연동하여 환자정보를 병원간 공유하기 위한 복합 식별 시스템 디자인에 그 목적을 두고 있다. 식별자와 관련된 기술과 표준, 그리고 UCI와 RFID간 연동관련 선행 연구에 대한 검토 후, SPMR을 디자인 하였다. 이에 의사들은 적시에 적절하게 의료 처치가 가능해 져서 환자들의 고통을 그만큼 경감시킬 수 있게 되었다.

Abstract

Linking Patient's medical records throughout country is required to get patient's accurate information which is helpful for doctor to diagnosis patient's symptoms more exactly. With shortening of time and preventing of retest, patient can be survived or alleviate suffering. Purpose of this paper is to design combined identification system linking patient's RFID card with medical digitalized Chart to share patient's information between the hospitals. With research and review of pre-studied related identification system, standardization, and UCI-RFID linkage study, SPMR(sharing patient's medical record) has been designed for doctors to make a medical treatment properly at the right time and alleviate patient's pain. SPMR(sharing patient's medical record) which will take information needed and pay for information usage to related hospitals has been designed for doctors to make a medical treatment properly at the right time and alleviate patient's pain.

▸ Keyword : SPMR, URN, UCI, RFID, EPC, Medical Digitalized Chart

• 제1저자 : 장덕성
• 접수일 : 2007.2.14, 심사일 : 2007.2.24, 심사완료일 : 2007.3.22.
* 동원대학 e-비즈니스과 부교수

Ⅰ. Preview

A lot of people frequently go to hospitals sometimes to dentist, sometimes to neighborhood clinic, sometimes to downtown clinic or general hospital in a lifetime . People have visited hospitals more than 3 times per person a year resulting 124,560,488 times in Korea as of 2003 (http://webseoul.metro.seoul.kr:6600). When doctors want to know history of medical treatment, medicine, and films ever taken for patient, there's no way to know but just guessing from patient's answer because patient's medical examination record is stored only at the visited hospital and patient's medical examination records are abolished when period of preservation is due according to the rules of hospital.

The veil of patient's past medical history, remedy, treatment, and prescription information affects doctors to retest and verification resulting delay of medical treatment. Delaying proper treatment seriously make a patient to suffer a fatal blow, pain and increase unnecessary expenses.

Patient's medical chart has identification number and maintains same identification number though medical examination record is updated unlike other digital contents which have different identification numbers. Every hospitals use their identification number to distinguish and record patient's information and issue patient's registration cards with same identification number issued which is unable to utilize between the hospitals.

In order to solve these problems, digitalization of medical chart, adoption of common identification scheme and building sharing system between hospitals are first things to do to achieve well being life.

Patient's medical card should be changed into Patient's medical card with RFID Tag ID based URN and it's inevitable to utilize UCI(Universal Content Identifier) authorized internationally(Lee et al.,, 2005).

UCI as a identification number for digital content distribution has a structure connectable with online and offline identification system of KOI(Knowledge Object Identifier), DOI(Digital Object Identifier), ISBN(International Standard Book Number), GTIN (Global Trade Identification Number). UCI can be used to identify offline object reading patient's medical card implanted RFID Tag ID which is getting patient's related information through converting into UCI.

Linking Patient's medical records throughout country is required to get patient's accurate information which is helpful for doctor to diagnosis patient's symptoms more exactly. With shortening of time and preventing of retest, patient can be survived or alleviate suffering. Purpose of this paper is to design combined identification system linking patient's RFID card with medical digitalized Chart to share patient's information between the hospitals.

With research and review of pre-studied related identification system, standardization, and UCI-RFID linkage study, SSPMR(sharing patient's medical record) which will take information needed and pay for information usage to related hospitals has been designed for doctors to make a medical treatment properly at right time and alleviate patient's pain.

1.1. UCI

Identification is an action to recognize relevant instance among many instances and a first step to select specific object exactly. Standardized identification system is necessary to avoid different recognition subjectively. UCI as a "standard to link between different identification system or system to manage after grant unique code to individual resource for efficient circulation and use of identifiable resources" is an articulated system between elements of syntax structure, meta data, operation procedure, operation system(NCA, 2006.2). UCI as an identification system based on URN(Uniform Resource Names), it appears to be a key code in the Ubiquitous environment because it can be used as a online conversion system(Lee et al.,

〈Table 1. Code characteristics among Prefix, Instance,Qualifier(Lee et al., 2005, readjustment)〉

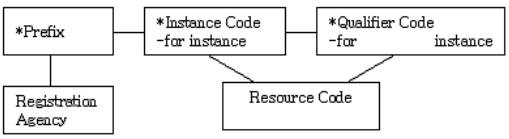
Code	Code formation	Target	Characteristics
Prefix (RA)	RA code expansion code - registrant code *RA code -Grant by Registration Authority(ROOT) -R(region),G(genre),I(institute),A * expansion code use when designate 2 steps RA -sub RA code (2 steps) - under 3 steps, registrant is described as a instance code * registrant code -optional code to describe registrant(producer, registration agency) -use by genre, regional RA -don't need when register by RA	-RA (instance resource mgmt. Institute)	*use as a information to convert URN to URL (URN issue: mgmt. Institution won't exist forever) *convertible structure and type -prefix code won't change when resource RA has changed or extinguished (Registration Authority will mapping with type of table). *support 3-tier and expansion structure *sub commitment authority of naming
Instance	(1) grant new identifier: -accept URN characteristic grant uci by system rule -useful when batch registration (2) reusing existing identifier existing identifier name(existing identification code)-expansion no. ex) ISBN 8912345678 chapter 9 ISBN(8912345678)-9 -expansion no.: authority of RA *not allowable nesting structure -UCI is not included in existing identifier	instance (RA) -grant by registrant	*cod uniqueness, permanency by RA *reflection of URN's functional requirement *existing identification should be registered to ROOT *distinguish lowercase and uppercase *expansion code is different with qualifier in that expansion code's range is limited and included in instance code
Qualifier	-support various format -grant several identification number according to the need of one resource CV02(Versional Copy: 02버전) RD1024x512(Display Resolution) "F"("pdf"|"doc"|"hwp"|"txt")	-instance -grant by registrant	*optional *RA will decide to use qualifier *managing various file with one metadata *change, delete, search of same group of instance *distinguish lowercase and uppercase

2005). UCI has characteristics of global scope, global uniqueness, legacy support, resolution, interoperability, publicity, hierarchical structure, polymorphism, inheritance. UCI utilizing at KISTI(Korea Institute of science and technology information) is an identifier to circulate digital content. UCI has been registered at TTA(Telecommunications Technology Association), DMP(Digital Media Project), IETF(Internet Engineering Task Force) for standard and IANA(Internet Assigned Numbers Authority) for name space.

1.2. UCI syntax structure

UCI has a structure to link with KOI(Knowledge Object Identifier), DOI(Digital Object Identifier), ISBN(International Standard Book Number), GTIN(Global Trade Identification Number) adopting on-offline identification system. UCI syntax structure registered at IETF RFC4179 (http://www. ietf.org /rfc/rfc4179.txt?number=4179 and described with ABNF(Augmented Bakus-Naur Form) defined at IETF RFC 2234. UCI syntax structure composed of Prefix Code, Instance Code, Qualifier Code. Prefix Code expresses information of registration agency handling instance resources. Registration Agency code can be divided R(region), G(genre), I(institute) and granted by Registration Authority. Instance code is granted to instances treated by Registration Agency and Qualifier code is an optional code granted

according to the type of expression of each instance.



〈Fig. 1. UCI structure(NCA, 2006.2)〉

resource, for example various type, easiness of content alteration, easiness of copy. When Registration Agency use existing identification system and qualifier code for special purpose should use after registration completed. Expansion code in instance code is different with qualifier code in that range of recognition for expansion code in instance code is limited and involved only in instance code.

UCI granting code for digital instance and

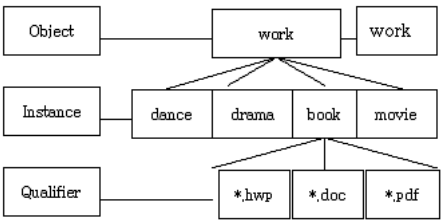
〈Table 2. Model of management of digital resources(NCA, 2006.2 readjustment)〉

Model	Contents
Solitary institution	*RA code -institution — * Resource code -grant no. of institution' - With organ own resource, developing various business model, using at framework guaranteed at interoperation.
Hierarchical institution	*RA code institutio — *Sub RA code -sub RA — *Registrant Code Sub RA registrant — *Resource code no. by registrant - possible to establish sub RA at region, institution - allowing 1 step sub RA(beginning with G)
Hub (portable)	*RA code -shopping mall code — *Registrant Code -Organ code — *Resource code no. granted according to shopping mall policy
Hub (copyright)	*RA code -deliberation committee of CR — *Registrant Code copyright code — *Resource code -no. granted to work, instance
Regional institution	*RA code -national code — *Sub RA code sub region/sub organ — *Registrant Code Registrant Code — *Resource code -grant by registrant - regional institution out of Korea(beginning with R), - one regional RA for specific region - sub RA can be established without distinguishof region, genre, insitution - 1 step sub RA(institution): 2 steps sub RA is not allowable - 1 step sub RA(region, genre): 2 steps sub RA is allowable

UCI has a structure providing information of complex multimedia content composed of sound, image, text etc.

Identifying resource easily when do the transaction and circulation on the internet identifying various resources like digital resource or physical resource on the basis of URN accepting characteristics of digital physical instance, different UCI for different work and instance is inevitable. For digital instance qualifier code is used to express same instance to various type of instance. For physical instance serial number is used for item produced massively. Relationship among object, instance, and qualifier of digital resource is as follow fig . There are solitary

model, hierarchical model, hub(portable) model, hub(copyright) model, and regional model to manage digital resources(NCA, 2006.2).

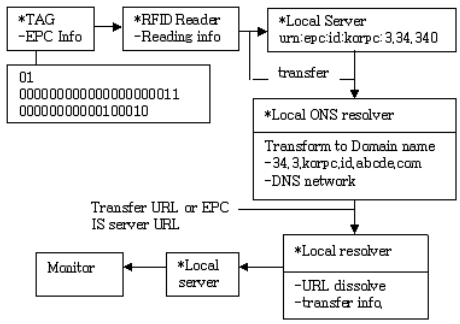


〈Fig. 2, Relationship among object, instance, and qualifier〉

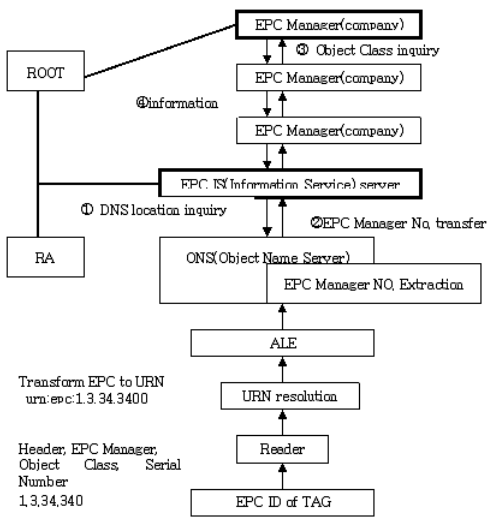
II. EPC(Electronic Product Code)

EPC, mCode, ISO is a RFID code system. RFID read information stored at Tag through reader, manage, and operate information with computer. Reader send RF carrier signal to tag, then tag send tag's data to reader by carrier radio frequency signal after frequency and amplitude modulation. Reader then send information to computer after reading received modulation signal. EPC coding object attached at tag to identify uniquely is a system built by EPC Global Inc. established by EAN and UCC(Uniform Code Council). EPC expressed by decimal digit and composed of header, EPC manager, object class, and serial number is recorded to tag wirelessly. After reading EPC code from Tag with wireless scanner and taking code as a Key to connect through internet, we can get related profile information from related DB. When corporation subscribe to EPCglobal Inc., they receive EPC Manager Number which is registered at ONS Registry managed by EPCglobal Inc. Corporation record EPC Manager Number, Product Number, and serial number to tag and write product's information by PML(Physical Markup Language) to product DB simultaneously.

PML file(country, product name, date, due date, period, directions, notice, ingredient, temperature, etc.) is stored EPC IS on the internet and delivered to corporation application. "EPC IS" which is located by ONS is a distributed system to manage and provide product information with PML(Cho dae jin, 2005).



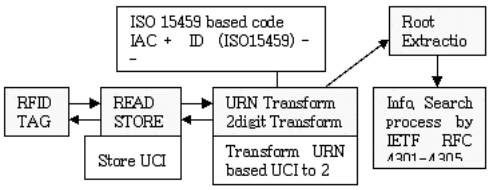
〈Fig. 3. Flow of inquiry of product information through RFID reader and ONS〉



〈Fig. 4. Flow of searching EPC ID of RFID TAG (NCA, 2005 readjustment)〉

III. Link between UCI and RFID

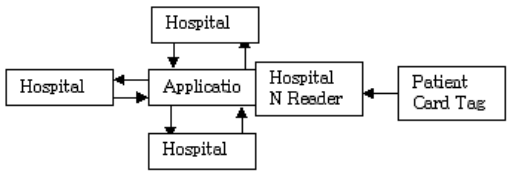
To make a right application of UCI to RFID, should use ISO 15459 based code. Link between UCI and RFID means storing UCI based code to RFID but linking EPC. To make a application of UCI to RFID internationally, IAC should be allotted from ISO. There are EPC, Bar Code, 2 dimension Barcode, and RFID in identification system granted to physical resource. Codes of EPC, Bar Code, 2 dimension Barcode, and RFID could be used as a part of UCI because of these code's digit expression. UCI can convert physical ID to UCI because it has a structure to incorporate physical resource code into a URN system which is two way convertible.



〈Fig. 5. Resolution between UCI and RFID〉

3.1. Design of SPMR

Each hospital has different system to manage patient's chart. Therefore unique key value is needed to distinguish each hospital. To get medical history of the patient through network, scheme of identification for patient's RFID card ID between hospitals is first thing to build. UCI authorized internationally has been used with the transformation of RFID ID into URN scheme.



〈Fig. 6. Sharing patient's information between hospitals〉

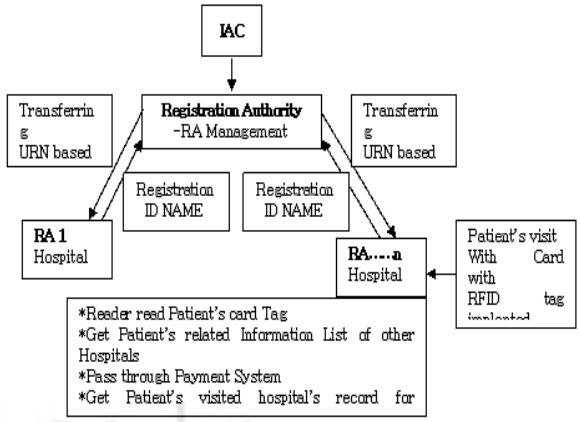
3.2. Code to share patient's information between hospitals

To share patient's information between hospitals, each hospital should build system and institute inner manual to accept other hospital's ID. Determine Registration Authority's code "I" for hospital using "ZXY" ISO15459 based international prefix for NCA from NEN, Registration Agency's code range "R10000 ~ R99999" which will indicated specific hospital, and instance code with "social security number" which identifiable each person and encoded allowing reading only in hospital's reader. To enroll and get identification's information, suppose to convert RFID Card of hospital to UCI Code like table 3.

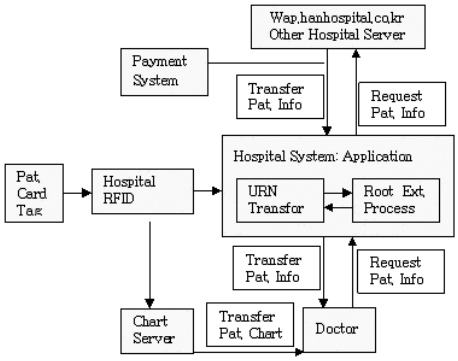
〈Table 3. Convert RFID Card of hospital into UCI Code〉

Physical RFID card ID	UCI
ZXY-100-1000-123456123456 7 -ZXY: International prefix for URN (ISO15459 based Prefix indicating NCA's UCI system)	Urn:uci:I100-R1000-12345612 34567 I100 (Korea hospital's Registration Authority Prefix) R10000- R99999 (RA) 1234561234567 (instance code with social security no.)

Flow of registration of patient's identifier is showed at Fig. 7. and searching patient's information is at Fig. 8.



〈Fig. 7. Registration of patient's identifier〉



〈Fig. 8. Process of searching patient's information〉

IV. Results

SPMR obtaining patient's medical record and information needed has been designed for doctors to make a medical treatment properly at right time and alleviate patient's pain resulting less medical expenses.

Each hospital has granted unique key value to distinguish each hospital. UCI has been used with the transformation of RFID ID into URN scheme allowing patient's information such as checkup, prescription, and treatment stored at hospitals share through internet between the hospitals with payment for information usage to related hospitals .

Determine Registration Authority's code "I" for hospital using "ZXY" ISO15459 based international prefix for NCA from NEN, Registration Agency's code range "R10000 ~ R99999" which will indicated specific hospital, and instance code with "social security number" which identifiable each person and encoded allowing reading only in hospital's reader. To enroll and get identification's information, supposed to convert RFID Card of hospital to UCI Code like table 3.

With the advent of Ubiquitous, U-health has been a topic to concern to the people for well being life. Research of UCI based platform in ubiquitous society shall be issued. In ubiquitous environment patient oriented diagnosing and treating will be prevailed.

For this reason, SPMR system will play a good role to achieve a pursuit of U-health through exchange patient's information in near future. But first thing to realize this system is to establish policies and BM(Business Model) to build mutual cooperation between the hospitals to share patient's information. To spread the results of this study, test bed of SPMR system would be required.

참고문헌

〔1〕 Cho dae jin, RFID theory and application, hongpub.co.kr, 2005

〔2〕 CrossRef, "2003 CrossRef Technical Working Group Meeting", CrossRef, 2003

〔3〕 Hendricks, "The development of the NISO Committee AX's OpenURL Standard", Inf Technol Libr 22 No.3, 2003

〔4〕 Lee et al., Study on the development of application using UCI system,NCA, 2005

〔5〕 Lee chang yul, Integration of digital resources with physical resources, 2006

〔6〕 NCA, UCI specification Ver2, 2006(MIC Information and Communication study developing project)

〔7〕 NCA, Study on the syntax structure of digital content identification system, 2003. 12

〔8〕 http://webseoul.metro.seoul.kr:6600

〔9〕 http://www.ietf.org/rfc/rfc4179.txt?number=4179)

〔10〕 Ex Libris(http://www.exlibris-usa.com

〔11〕 Cate(http://www.openly.com/)

저 자 소 개

장 덕 성

경원대학교 경영정보(박사)

고려대학교 경영정보(석사)

서울산업대학교 산업공학과(학사)

〈관심분야〉

e-business, U-care, Electronic document