The System And Software Requirements Definitions for 2MB

Team Dec 14, 2019

1. SSRD

The System and Software Requirements Definition purpose is to give an extensive overview of the project at hand. This application which provides medical information for both patients & hospital is called '2MB'. The SSRD documentation was produced through the Easy WinWin negotiation and further discussions about the application. The SSRD is divided into 5 sections which are: Project, Capability, Interface, Level of Service and Evolution.

1. Introduction

1.1 Purpose of SSRD

The SSRD describes the requirements for the proposed Blockchain-based medical information system, unifying the vision behind the project, and serves as a guideline for most future activities. The primary purpose of SSRD is to specify the fundamental features the proposed system should have and under what constraints it must be developed. As this information was obtained after the Win-Win negotiations have done during the 'software engineering' class, the requirements presented in this document resulted from interaction with representatives of all the stakeholders. These include the customer (Patients), the development team, a number of hospitals that will use our system, and a number of prospective users of the system with different levels of computer knowledge. This document will help to bridge the gap between the business domain and the computer domain. The requirements were categorized into five main topics: project, capability, interface, level of service, and evolution. In what follows, we present and discuss those requirements within the context of the blockchain-based medical information system. SSRD should prevent future conflict and additional work. Despite that, we will still check the validity of this document regularly during the design and implementation phases and change according to new information.

1.2 Reference

- Easy WinWin negotiation report (10/02/2019).

1.3 Change Summary

Date	Author	Title	Version	Changes
10/13/2019	**Every Team Member**	**Initial version**	**0.1**	**The initial version, having a high potential of correction**

2. Project Requirements

The project requirements consist of general constraints and mandates placed upon the design team, as well as non-negotiable global constraints. Project Requirements are such that, if they were left unmet, then the proposed system would not be acceptable or would not satisfy Win-Win conditions for the success-critical stakeholders.

This section explains the project requirements that affect the overall project.

2.1.1 Project Goal Definition

Project Goal:	PG-1: Blockchain network
Description:	The security of medical information should be obtained using the blockchain network.
Measurable:	The blockchain network should be implemented and operable to be within 4 weeks.
Achievable:	The project shall be completed rapidly to sustain the company's competitive edge. The user interface must be compatible with other company systems. Moreover, the system must be compatible with legacy code or systems.
Relevant:	The team members should be efforted enough to make and manage the blockchain network. Whatever the relevant is, this should be relevant to the OCD.
Specific:	Technical constraints

Project Goal:	PG-2: Operating system constraint
Description:	The system must run on the Android and Windows operating systems.

Measurable:	Any behaviors of the app on the OS should not terminate forcefully with errors.
Achievable:	App for patient users should run on the Android system, and software for hospital users should run on the Windows system.
Relevant:	The operating system has to coordinate the computer resources and to service applications.
Specific:	Technical constraints

Project Goal:	PG-3: Main server - blockchain network - app compatibility:
Description:	All three systems should be compatible with certain connection appointment, preventing any errors or subsequences on communication with each other.
Measurable:	The specific code and header should be appointed before each of them is implemented and executed in any form (such as excel form: HEADER LOGI for login).
Achievable:	The three types of all systems should be connected to each other to equal ports, headers, and standard forms of sending data.
Relevant:	Each team to develop and make the application should be aware of the ports, headers, and other standard forms.
Specific:	Technical constraints

Project Goal:	PG-4: Customer needs
Description:	The system should comply with the needs of customer based on Easy Win-Win negotiation report.
Measurable:	The system of development available with modifying with any parts of the program for meeting with user's needs.
Achievable:	In any tools, the client must be available with project manager to ask for the functionality of the application.
Relevant:	This goal is relevant to Easy Win-Win negotiation report
Specific:	Reading and understandability of team.

Project Goal:	PG-5: Project Budget
Description:	Build total system within the budget
Measurable:	Development cost should not exceed $ 10000
Achievable:	Minimize evitable development cost increase
Relevant:	Budgeting prevents unnecessary costs and allocates the correct amount of the budget to each corresponding need.
Specific:	Budget

Project Goal:	PG-6: Project Schedule
Description:	The Prototype of the system should be capable of being exhibited before demo day of software engineering class
Measurable:	The Prototype of the system must be completed by two weeks before the date of the last demo presentation.
Achievable:	Develop Prototype through the schedule under the instruction of team leader.
Relevant:	Serves as a management tool for overseeing the progress of the project as well as for evaluating alternative strategies for project goals.
Specific:	Schedule

Project Goal:	PG-7: Final Product
Description:	The final product should be reachable through predefined ways.
Measurable:	The final product is launched on the application market platform and also can be downloaded through the web.
Achievable:	Develop final project be installable package, mobile application which can be accepted to the application market.
Relevant:	At this point, the proposed product end all the development phase with a detailed objective. And as a final step, gather all products with specification documents and ensure that all required members have agreed.

Specific:	Packaging

2.1.2 Budget and Schedule

These are mandated costs and schedule constraints in terms of money and calendar months available for project completion.

Project requirement:	PR-1: Cost Minimization
Description:	Minimize the total cost of development
Measurable:	Total development cost should not exceed $10000
Achievable:	The app will be developed as a project for a Software Engineering course.
Relevant:	Their requirement is relevant to PG-5
Specific:	Budget
Reference:	

Project requirement:	PR-2: Prototype Completion Schedule
Description:	Design the system and build the prototype in twelve weeks after the team formation(Details: Finish Backend within 1~2 weeks. The final design is done within 3~4 weeks. Combining Backend & Frontend within 5~6 weeks Analyze and design the system within 12 weeks)
Measurable:	The prototype of the system must be completed by two weeks before the date of the last demo presentation.
Achievable:	Provide the crucial features of the system upon the user, customer requirements.
Relevant:	This is the time allowed for the project, specific timelines for the product cycles should be determined and followed under the instruction of the team leader. This is relevant to PG-6
Specific:	Schedule constraints
Reference:	

Project requirement:	PR-3: Continuous Feedback Schedule
Description:	After finishing the initial prototype, perform customer feedback through face to face interviews and surveys. Moreover, apply the feedback into our prototype repetitively to fulfill their needs in our project.
Measurable:	There will be at least five times of feedback before the final presentation date.
Achievable:	Check whether our implementation of the requirements really matches with actual customer needs.
Relevant:	Feedback should be multi-directional and include peer-to-peer feedback and upward feedback for the adaptation of all the team members. Also, it makes more sense to train and let you constructively receive feedback. This is relevant to PG-6.
Specific:	Schedule constraints
Reference:	

2.2 Development Requirements

2.2.1 Tools Requirements

Tools Requirements	PR-4 : Tools to use	
System Type	Languages	Lists of IDE(Tools)
For application	Android: Java (or Kotlin)	Eclipse ADT (Android Developer Tools) Bundle or Android Studio
Server and Database Deployment	C, SQL	Azure SQL
Others: User-environment	Html, CSS	Notepad ++

2.2.2 Language Requirements

The following would be the languages used to develop the application within the stipulated period:

Project Requirements	PR-5(Language Requirements)
Front-end development	HTML, CSS, PHP, Java, Kotlin, Swift
Back-end development	PHP, MySQL , C++, Python
For application	Swift(IOS), Java and Kotlin(Android)

2.2.3 Computer Hardware Requirements

The main server processor should be fast and stable enough to keep access to the network between users and blockchain networks. It should perform ultimate network speed using server optimized network cards, such as Intel ET1000. The below figure represents the hardware specification.

Project Requirements	PR-6(Hardware Requirements)
Processor	2 vcpus
Memory	8 GiB
Data Disks	4
Max IOPs	3200
Temporary Storage	16GiB
Premium disk	All SSD
NIC	Intel ET 1000

2.2.4 Computer Software Requirements

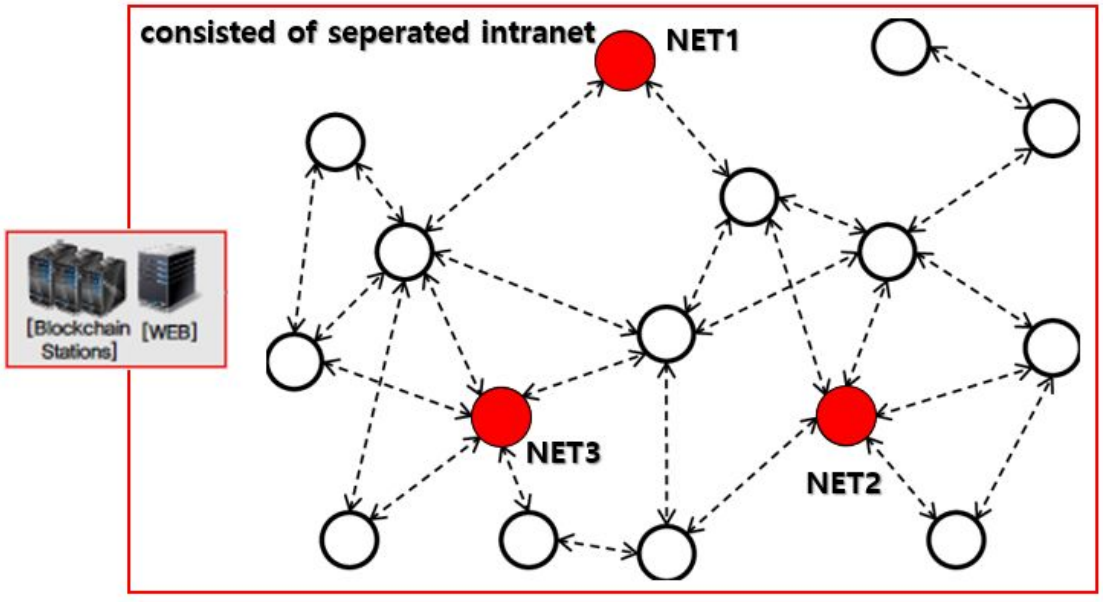
Linux OS is used companion to Postgres server for accessing data on a database server and the private server regarding the blockchain server. This can be modified into a UNIX server in the better one. Hycon 2.0 is a blockchain engine for an enterprise-scale system. It has state of the art consensus algorithm Specter. The other specifications are like the below figure.

Project Requirements	PR-7(Software Requirements)

OS	Ubuntu Server 18.04 LTS
Databases 1(Blockchain SubDB)	MSSQL 15.0
Databases 2(Main DB)	PostgreSQL 12
Databases 3(Any Type DB)	Oracle NoSQL 19.3.12
Blockchain engine	Hycon 2.0(private network)
Test Environment	Azure Virtual Machine (Seoul region, Ubuntu Server 18.04 LTS)

2.2.5 Computer Communication Requirements

Our project didn't adopt fully distributed network topology but partially centered topology for machine position. It is because the objective of using blockchain is only stably storing data. Thus, as we adopted the partly clustered topology, the system can fastly process authentication, but also it got stability as a data storage. The below figure indicates our system topology.



[figure 1] system topology consisted of intranets.

2.2.6 Others

Project requirement:	PR-8

Description:	Each team leader communicates regularly with the other team leader
Measurable:	Each team leader meets with the other team leader once a week.
Achievable:	Set a regular weekly meeting with the team leader.
Relevant:	Regular meetings between team leaders will help the development team stay on the right track for the analysis of the project and keep up with the operation & marketing team. This is relevant to PG-5
Specific:	External Team Meeting
Reference:	

Project requirement:	PR-9
Description:	Regular Team meetings
Measurable:	The team should meet twice a week until the end of the semester. Additional meetings possible if urgent.
Achievable:	Set a regular weekly team meeting.
Relevant:	Regular meetings will help every member to be on the same page of the project. This is relevant to PG-5
Specific:	Schedule constraints
Reference:	

2.3 Packaging Requirements

Project requirement:	PR-10
Description:	Provide a demo video for the client
Measurable:	Provide a demo video that gives a brief walk-through of how the system works.
Achievable:	Provide the demo video to the user.
Relevant:	Help the user to see the whole administration flow of the system. This is relevant to PG-4

Specific:	Administration
Reference:	

Project requirement:	PR-11
Description:	Provide a documentation for the client
Measurable:	Provide an in-depth documentation describing the architecture design of the system. If a client wants specific manual, provide hyperlink UI in application software.
Achievable:	Provide the LCA document package to the client. Use UML in SSAD determined while implementing the system.
Relevant:	Providing complete documentation to ISD, will help the understanding of the client of the system security. Include costs expected on implantation. This is relevant to PG-4
Specific:	Maintenance cost, Administration
Reference:	

2.4 Deployment Requirements

Project requirement:	PR-12: The Security of server
Description:	The server should be installed in a stable location, which should guarantee performance and security.
Measurable:	The server should be able to be reached in any case of clients, even though the server traffic is high.
Achievable:	Server speed and inspection of the security should achieve specific values.
Relevant:	The server will prevent unauthorized users from accessing personal information and will have information accessible stored on one or multiple devices. This is relevant to PG-3,4
Specific:	Economical constraints for the price of the server.

Project requirement:	PR-13: The installation of application

Description:	The clients should be able to reach the result of our development and researches regarding their OS situation.
Measurable:	The application should be reachable through downloading windows app package through the homepage, google play store or IOS app store.
Achievable:	Through the searching on any portal sites, the user can access our homepage/apps.
Relevant:	The server should be made through HTML and back-end servers to the front-end server. This is relevant to PG-2,7.
Specific:	

Project requirement:	PR-14: The installation of software
Description:	The clients should be able to reach the result of our development and researches.
Measurable:	The software should be reachable through download & manual installation on Windows operating system. Specific UI should be assigned regarding each hospital.
Achievable:	The download page should differ according to the user account based on the user's hospital information.
Relevant:	The account of the hospital should be classified into certain categories, such as a dental clinic, or 2nd hospital. This is relevant to PG-2, 7.
Specific:	

2.5 Transition Requirements

Project requirement:	PR-15: Front-end development skill requirement
Description:	The front-end system must be developed both web and app. - - Web development with the trio, HTML (critical structural component of any website) with CSS (allow to build websites and apps), and interactive with JavaScript. App development with JAVA (critical structural component of any Android application) and interaction with blockchain network be developed with Rust API

Measurable:	HTML, CSS, JavaScript, JAVA, Rust API, SQL languages skill
Achievable:	Minimize the amount of code, and must keep in mind the tools and skills used to create the front-end of a system.
Relevant:	Technical details to solve a particular problem, proficient testing and debugging, version control must be done. This requirement is related to PG-3.
Specific:	

Project requirement:	PR-16: Back-end development skill requirement
Description:	Mainly focused on private blockchain, databases, scripting, and websites developed with Python and C++ languages within MySQL and PHP.
Measurable:	PHP, MySQL , C++, Python
Achievable:	Minimize the amount of code, and must keep in mind the tools and skills used to create the back-end server.
Relevant:	Must have a technical understanding of website and come up with practical solutions, have skills for implementation algorithms and solving system related problems, manage APIs resources, store data and ensure it well, etc. This requirement is related to PG-3
Specific:	

2.6 Support Environment Requirements

Project requirement:	SER-1
Description:	Gather medical information of patients from the local clinic.
Measurable:	A list of patients' medical records should be received.
Achievable:	Receive excel file containing needed information from the local clinic.
Relevant:	This documentation is crucial to the implementation of the system. Given that the proposed system needs to develop proper form. This is related to PG-3

Specific:	Administration, Maintenance cost
Reference:	

3. Capability Requirements

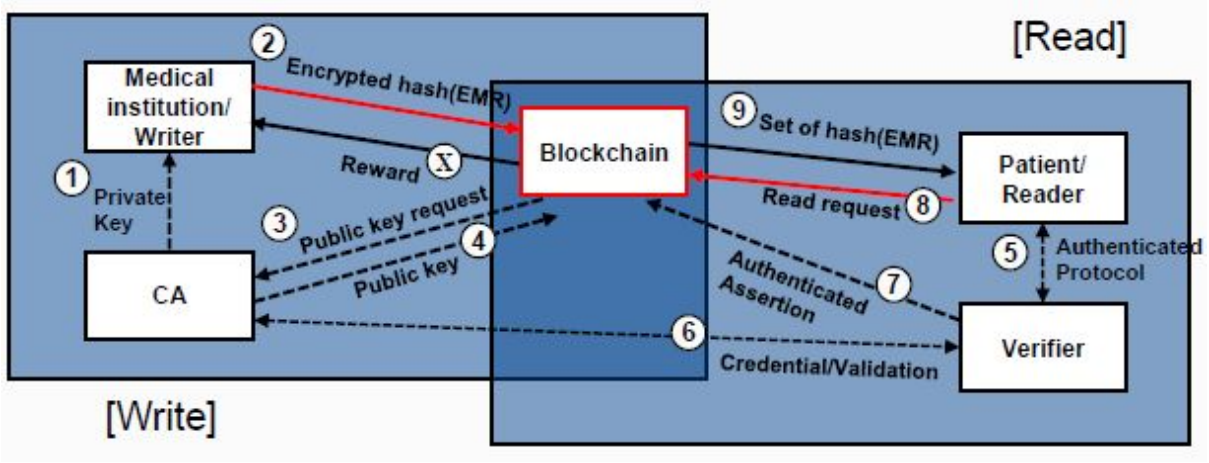
This section describes the proposed system and analyzes its requirements.

3.1 System Definition

We are planning to develop a blockchain-based medical record database system which we are going to call ‘2MB’. Two clients (Hospital & patients), and an abbreviation of ‘Medical Blockchain’, all together as ‘2MB’. Our service will save the patient’s private medical records of particular hospitals and protect them from being altered illegally or used for immoral purposes.

We adapted the blockchain system because blockchain utilizes powerful cryptography and gives individuals ownership of an address and the crypto assets. Medical records are critically important in medical-related lawsuit cases, and blockchain technology offers a great level of security to individual users. Furthermore, Alliance with a government can give the patients a UX which was one of the weaknesses of blockchain application.

Individual users will be able to browse their personal medical data using our service and use them in case of medical-related accidents. Hospitals will be able to do so as well. The following will further explain the functions and capabilities of the system.



[Figure 2] interaction model in the blockchain for the high reliability

3.2 System Requirements

The requirements for the system defined in the previous section are described below in terms of nominal and off-nominal requirements.

3.2.0 Login Mode

3.2.0.1 Nominal Requirements

Requirement:	**RQ-L-1**
Title	Login
Priority	Very High
Description	Provides personal service to users through login.
Input(s)	User ID and password.
Source(s)	User input
Output(s)	Access denied for unmatched ID&PW and allow access for correct ID&PW
Destination(s)	User Interface
Precondition(s)	Have to Download the application on an applicable device
Postcondition(s)	Depends on the type of the User there will be a different types of interface appear to the User. Types of User: Hospital Account, Patient Account
Proposed Activity	
WinWin Agreements	WWE1
Mainstream Scenario	In the login page, there will be an additional input column choosing the type of user between hospitals and patients. After a successful login, there will be different interfaces shown to each user.
Exception Handling	ONRQ-L-1

3.2.0.2 Off-Nominal Requirements

Requirement:	**ONRQ-L-1**
Title:	login error
Priority:	High
Description:	If the user inputs the login information incorrectly, access is not allowed.
Traceability:	

3.2.1 Hospital Mode

3.2.1.1 Nominal Requirements

Requirement:	**RQ-H-1**
Title	Highly Reliable Blockchain Engine
Priority	Very High
Description	As it is a service based on trust, we should establish an environment that our customers can trust like the *figure 1*.
Input(s)	Blockchain engine
Source(s)	medical data
Output(s)	Reliable sophisticated blockchain system
Destination(s)	Blockchain Engine
Precondition(s)	The engine has to be activated

Postcondition(s)	
Proposed Activity	
WinWin Agreements	WWE2
Mainstream Scenario	From the perspective of normal patients, the usage of blockchain will not be recognized as a highly efficient mechanism. However, in the court, "blockchain" will be the biggest factor to put weight on your medical assertion.
Exception Handling	

Requirement:	**RQ-H-2**
Title	Saving ERM input Data
Priority	High
Description	As medical data has very diverse type of input, blockchain system and database system can store these data and metadata. Thus NoSQL is requires.
Input(s)	any type of data
Source(s)	Medical records
Output(s)	1. system response which indicates whether the operation is normal or abnormal 2. the input hash data will be in the blockchain DB
Destination(s)	Blockchain Engine
Precondition(s)	RQ-L-1

Postcondition(s)	ERM data should be stored in blockchain.
Proposed Activity	
WinWin Agreements	WWE3
Mainstream Scenario	When the doctors of hospitals enter X-ray image data in the system, the system must store the data normally.
Exception Handling	ONRQ-H-1

Requirement:	**RQ-H-3**
Title	The window for patient medical data which will be utilized to lure frequent visit of patients
Priority	High
Description	Since medical data itself is very sensitive in law, the hospital will not open the entire patient's medical record to the system. Therefore, the hospital will selectively choose the data they want to provide to us. Here this window is the window that shows to hospital account to selectively provide patient medical reports to the system in which our system will utilize the data to proceed PG-P-1.
Input(s)	any type of data that include medical record
Source(s)	User input
Output(s)	1. system response which indicates whether the operation is normal or abnormal 2. save the record to system DB
Destination(s)	system DB
Precondition(s)	RQ-L-1

Postcondition(s)	message showing whether the data is successfully saved or not
Proposed Activity	
WinWin Agreements	WWE4
Mainstream Scenario	When the doctors of hospitals enter any medical record of the patient (eg. X-ray image) in the system, the system must store the data normally.
Exception Handling	ONRQ-H-2

Requirement:	**RQ-H-4**
Title	Authentication features for EMR data
Priority	High
Description	Blockchain can be used to prove that ERM data is flawless without falsification.
Input(s)	EMR data
Source(s)	Any medical records
Output(s)	Whether EMR data is true or not
Destination(s)	Blockchain DB
Precondition(s)	RQ-H-2, which means the EMR data should be already stored inside the blockchain DB to be authenticated
Postcondition(s)	show the message that shows whether the EMR is true or not

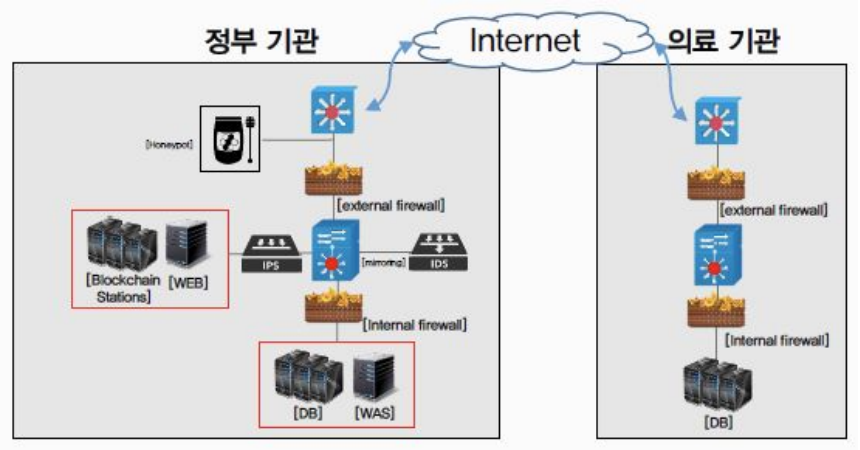
Proposed Activity	
WinWin Agreements	WWE5
Mainstream Scenario	if the user puts QR code of the EMR data into the system the system will verify whether the EMR is modified or not, and show the user the result of the authentification.
Exception Handling	ONRQ-H-2

3.2.1.2 Off-Nominal Requirements

Requirement:	**ONRQ-H-1**
Title:	EMR data not found
Priority:	Medium
Description:	if the user puts the QR code of the EMR data into the system, and if the given hash data of the EMR data is not found in Blockchain DB, then there will be a message appear to tell the user that the data is not present in the DB.
Traceability:	

Requirement:	**ONRQ-H-2**
Title:	EMR data Authentication fail
Priority:	Medium
Description:	if the user puts the QR code of the EMR data into the system the system will verify whether the EMR is modified or not. However, if the medical data's hash data has been modified and doesn't match

	with the data from Blockchain DB, then there will be a message appear to tell the user that the data has been modified.
Traceability:	

Requirement:	**ONRQ-H-3**
Title:	Failed to save patient clinical data
Priority:	Medium
Description:	After RQ-H-3, if there is an error in the intranet so that the data can't reach the server, then then there will be a message appear to tell the user that there is network error.  From the topology, it is highly possible that the intranet has a problem.
Traceability:	

Requirement:	**ONRQ-H-4**
Title:	Not logging out
Priority:	Medium

Description:	If the user does not log out, to protect his or her personal information the application automatically logs out when he/she is not active for a long period of time.
Traceability:	

3.2.2 Patient Mode

3.2.2.1 Nominal Requirements

Requirement:	**RQ-P-1**
Title	Recommendation Service
Priority	Low
Description	Recommend appropriate medical services, such as regular checkups and scaling
Input(s)	User's consent to receive advertising
Source(s)	DataBase
Output(s)	Smartphone alarm
Destination(s)	User interface
Precondition(s)	The users have to agree with receiving advertising notice
Postcondition(s)	The push notification will appear in the device to remind the revisit date of the medical check.
Proposed Activity	
WinWin Agreements	WWE6

Mainstream Scenario	Users can keep their bodies healthier by being recommended medical services at the right time.
Exception Handling	

Requirement:	**RQ-P-2**
Title	Authentication features for EMR data
Priority	High
Description	Blockchain can be used to prove that ERM data is flawless without falsification.
Input(s)	EMR data
Source(s)	Any medical records
Output(s)	Whether EMR data is true or not
Destination(s)	Blockchain DB
Precondition(s)	RQ-H-2, which means the EMR data should be already stored inside the blockchain DB to be authenticated
Postcondition(s)	show the message that shows whether the EMR is true or not
Proposed Activity	
WinWin Agreements	WWE5
Mainstream Scenario	if the user puts QR code of the EMR data into the system the system will verify whether the EMR is modified or not, and show the user the result of the authentification.

Exception Handling	ONRQ-P-2

3.2.2.2 Off-Nominal Requirements

Requirement:	**ONRQ-P-1**
Title:	EMR data not found
Priority:	Medium
Description:	if the user puts the QR code of the EMR data into the system, and if the given hash data of the EMR data is not found in Blockchain DB, then there will be a message appear to tell the user that the data is not present in the DB.
Traceability:	

Requirement:	**ONRQ-P-2**
Title:	EMR data Authentication fail
Priority:	Medium
Description:	if the user puts the QR code of the EMR data into the system the system will verify whether the EMR is modified or not. However, if the medical data's hash data has been modified and doesn't match with the data from Blockchain DB, then there will be a message appear to tell the user that the data has been modified.
Traceability:	

Requirement:	**ONRQ-P-3**
Title:	Not logging out

Priority:	Medium
Description:	If the user does not log out, to protect his or her personal information the application automatically logs out when he/she is not active for a long period of time.
Traceability:	

4. System Interface Requirements

This section describes how the proposed system will interact with other systems with its users.

4.1 User Interface Requirements

4.1.1 Graphical user Interface Standards

Project requirement:	**SIR-1**
Description:	Easy to use
Measurable:	Utilize icons to allow users to use applications intuitively.
Achievable:	The users can easily use the application without learning how to use it.
Relevant:	Everyone should be easy to use, as older people who are not familiar with the use of applications frequently use hospitals.
Reference:	[1] figure 2 shows the system hides a complexity of server sides and lets users interpret the results easily.

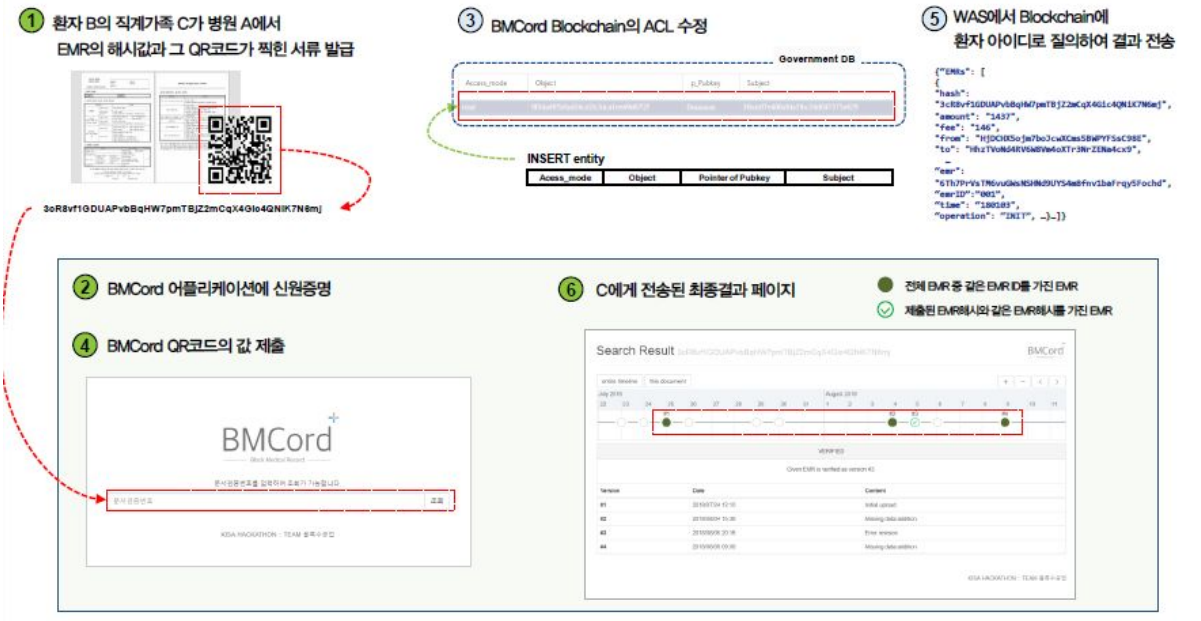
Project requirement:	**SIR-2**
Description:	Easy to add a medical record

Measurable:	Through the automated process, medical records can be quickly recorded on the blockchain.
Achievable:	The hospital does not feel uncomfortable using the application.
Relevant:	The easy process of storing medical records makes hospitals want to use applications.
Reference:	

Project requirement:	**SIR-3**
Description:	highly legible font
Measurable:	Use of large font and color to make UI at a glance.
Achievable:	Easily understand services for all users.
Relevant:	It not only makes it easier for older people to use it, but it also reduces the number of mistakes in making the wrong.
Reference:	

Project requirement:	**SIR-4**
Description:	Accessibility for the disabled
Measurable:	Use mobile app accessibility guidelines
Achievable:	Easily accessible services for the disabled
Relevant:	disabled people should be easy to access our service.
Reference:	http://www.webwatch.or.kr/MA/020201.html?MenuCD=220

Project requirement:	SIR-6
Description:	visually explaining the results of querying data.
Measurable:	reducing the time of staying result page
Achievable:	Easily accessible services for all users
Relevant:	easily make the grounds for a lawsuit
Reference:	visual reference[1] figure 2, interaction 6



[figure 2] interaction diagram in the UI(both the user side and server-side)

The proposed system will use a mobile app-based Graphic User Interface which will have the following characteristics:

- Landing Page containing simple options : ‘Hospital’ or ‘Individual patient’. Once the client enters the app home page, he/she will see a simple screen with two buttons so he/she can choose their own identity.
- Identity check page : In order to access personal medical data, clients will have to verify their identity. If the client is a patient, he/she will already own the QR-code

provided from the hospital, containing the encrypted hash-values of his/her medical record. The identity will be verified by scanning the QR code.

- Information request page
  Clients will be able to choose which service they are looking for. There will be a button that says ‘View your Records’.
- Information Result page
  After identity verification, clients will be able to access this page showing all the hash values of their medical records, provided by our blockchain system.

4.1.2 Command-Line Interface Requirements

Any direct CLI command is not necessary. The application communicates with the smartphones or the computers using APIs provided the Operating System.

Project Requirements	CLIR
Nothing	Nothing

4.1.3 Diagnostics Requirements

Diagnostics requirement	Obtaining debugging information
Description	When the system crashes by unexpected error, the given system generates a report chart as an alert with a predefined error code.
Measurable	The developer can receive an actual error report.
Achievable	Users can select between neglecting or sending error reports to the developer.
Relevant	The developer replicates the failure to identify the cause and prevent it from modifying and deleting code.

4.2 Hardware Interface Requirements

No additional hardware is required except computers and smartphones.

4.3 Communications interface Requirements

The system is given using data from the patients' smartphone using 80 HTTP port. Meanwhile, from the hospitals, WAS(Web Administrative System) takes data related to EMR using port 8181.

Project Requirements	CIR
Patients' Data	8080(HTTP) of Web Server
Hospitals' Data	8181(HTTPS) of Web Administrative Server

4.4 Other Software Interface Requirements

Project requirement:	**OSIR-1**
Description:	automatic recognition of document's QR code for querying blockchain data
Measurable:	reducing the time of entering a unique document's code
Achievable:	Easily accessible services for all users
Relevant:	reducing mistakes and time for user input is important issues in Human-Computer interactions.
Reference:	visual reference[1] figure 2, interaction 1

5. Level of Service Requirements

In this section, we discuss how well the system should perform.

Project requirement	LOR-1
Description	Meet the Current security standards(guideline)
Measurable	Unauthorized users shouldn't be able to gain access to the system.
Achievable	Reliable security of the system

Relevant	Security
Specific	If the application is not secure, customers will not trust the service.
Reference	WWE1

Project requirement	LOR-2
Description	System must not be down
Measurable	System should provide service 24/7
Achievable	Use the System Monitoring Service to check system status
Relevant	Stability
Specific	If the system is not stability, customers will not trust the service.
Reference	WWE1

Project requirement	LOR-3
Description	Provide access to application anytime, anywhere
Measurable	Access to the system should be possible from any device with the application and internet connection on a 24/7 basis.
Achievable	App-based interface
Relevant	Ease of use
Specific	Will increase the usability of the system.
Reference	WWE7

Project requirement	LOR-4
Description	No configuration necessary for the first-time usage
Measurable	The user should be able to use the system by logging-in, without having to configure anything. Default settings will be used.
Achievable	Maintain default settings
Relevant	Ease of use
Specific	Users with minimal computer knowledge will be able to use the system.
Reference	WWE7

Project requirement	LOR-5
Description	Easy to maintain the system
Measurable	The system administrator should be able to maintain the system after studying the documentation provided for simple use and maintenance. Regular maintenance should not average more than 1-2 hours a week.
Achievable	
Relevant	Relevant to the cost of ownership, availability
Specific	This will help to minimize the cost of the system and maximize its availability.
Reference	WWE8

Project requirement	LOR-6
Description	Easy Authentication Process
Measurable	Authenticating a medical record shouldn’t take more than 3 touches

Achievable	Pasting the hash value to the application should bring up the Authentication result. The user must put the QR code of the medical file as an input and click ok. All other procedures (uploading etc) will be handled by the system.
Relevant	Ease of use
Specific	Users with minimal computer knowledge will be able to use attachments
Reference	WWE7

Project requirement	LOR-7
Description	Low training time for general users
Measurable	Users should be able to use the system regardless of their computer knowledge.
Achievable	
Relevant	Ease of use
Specific	With low training time, most users will be able to start using the system fast.
Reference	WWE8

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6. Evolution Requirements

Describe any requirements on the flexibility and expandability that must be provided to support anticipated areas of growth or changes in technology

Describe foreseeable directions of the system growth and change
Evolution requirements concern with foreseeable directions of the system, like for example the growth rate of the system and which features can probably change in the future.

6.1 Capability Evolution Requirements

·Major post-IOC capability requirements

Project requirement:	CR-1
Description:	Provide comprehensive health care service alarm
Measurable:	The alarm service will make people know their date to visit the hospital.
Achievable:	Give a date for a medical examination and vaccinate
Relevant:	User Experience
Specific:	The user doesn’t need to remember the date to go to the hospital.
Reference:	WWE4

Project requirement:	CR-2
Description:	Struct primary care provider network connected to the blockchain network
Measurable:	primary care provider network can be regarded as a medical cluster
Achievable:	bring into the primary care providers and provide benefits
Relevant:	User Experience
Specific:	the hospitals in the cluster share user data, so the patients can avoid complex tests such as computed tomography
Reference:	WWE3

6.2 Interface Evolution Requirements

·Describe any proposed systems with which this system must interoperate and evolve with
·How must the system adapt to interface changes?
·Organizational changes in use on the system
·Personal changes (more, less, different style)

·New or expanded product lines
·Policy changes
·Organization restructure
·New/additional/dissolved relationships
·External systems
·New/additional/replace system
·Changes in external interfaces

Project requirement:	CR-3
Description:	Provide the guide manual
Measurable:	Old people have a difficulty dealing with the application.
Achievable:	Make the guide manual that let old people to know how to use application.
Relevant:	Ease of use
Specific:	A guide manual that helps to use application will be provided for the elderly to use easily.
Reference:	Baharum, Aslina & Mat Zain, Nurul Hidayah & Taharudin, Aryanto & Hanapi, Rozita & Saudi, Azali & Alfred, Rayner. (2017). Guidelines of User Interface Design for Elderly Mobile Applications: A Preliminary Study. Asian Journal of Information Technology. 16. 38-44. 10.3923/ajit.2017.38.44.

Project requirement:	CR-4
Description:	Extensible for logging into multiple accounts simultaneously.
Measurable:	Users with multiple accounts should be able to see messages from all of them when they log in.
Achievable:	The process of reading messages will be “repeated” for each account.
Relevant:	Ease of use
Specific:	Will help users check all their medical records in less time. Also to make parents to manage child health care, aiming for the childrens who can’t manage to handle their hospital schedules

Reference:	WWE7

6.3 Technology Evolution Requirements

·Describe the strategy towards the adoption of future technologies with the product.

Project requirement:	CR-5
Description:	data change detection
Measurable:	When some hospital changes data and hide it, we need something to trace their behavior.
Achievable:	When some data is changed secretly in hospital's database, our program detects the change and records it.
Relevant:	We can mediate between hospital and patient.
Specific:	Accepting new technology
Reference:	WWE2

Project requirement:	CR-6
Description:	Introduce distributed storage
Measurable:	If the storage below the blockchain is filled with data, service quality will go off and the cost will increase more.
Achievable:	Make the storages being seperated like blockchain network
Relevant:	High Scalability
Specific:	Storage space can be used efficiently, even as the number of information increases.
Reference:	Sudarshan S. Chawa, Clustering Blockchain Data, Clustering Methods for Big Data Analytics(2019) pp 43-72

7. Common Definition Language

EMR

Electronic Medical Record (EMR) is a computerized chart of patients on traditional paper since the mid-1990s when personal computer PCs became common.
The major items include the patient's personal information, medical history, examination results, treatment results, surgical records, hospitalization records, and outpatient care.

BM QR code

Blockchain Medical(BM) QR code is a hash value which means a unique document ID. the hospital of 2MB network includes the BM QR code into the EMR document and the client of the hospital can submit BM QR code to his or her application. After that, the patient can examine a result of tracking the issued EMR document’s edit record.

Private Blockchain

Private blockchain is also called "Permissioned Ledger." There are pre-designated participants who can participate in the reading, writing and agreement processes, and specific subjects can be newly added or removed as necessary. In addition, depending on design purposes, private blockchains can be designed in different versions.

Front and Back End

In software engineering, the terms front end and back end refer to the separation of concerns between the presentation layer (front end), and the data access layer (back end) of a piece of software, or the physical infrastructure or hardware. In the client-server model, the client is usually considered the front end and the server is usually considered the back end, even when some presentation work is actually done on the server itself.

Hash

Hash function refers to a function that maps data of a fixed length to any data with any length. The value of a fixed-length resulting from the application of these hash functions is called a hash value.

Appendix

WinWin Result(for each Stakeholders)

Hospital Requirements

H1 : Easy to manage patient information
H2 : Safe Patient Information Protection
H3 : Original Warranty with Patient Information Modulation
H4 : Recommend medical check up for patients who need
H5 : Doctors can check medical records regardless of location.
H6 : Low price to retain patients from revisiting, and low price system to authenticate that the data hasn’t been modified

Patient Requirements

P1 : Easy to use
P2 : An improvement in health
P3 : Easy-to-use interface for older patients considering their age range
P4 : Simplicity of health information retrieval
P5 : Original guarantee based on patient information and clinical record modulation to avoid adverse outcomes
P6 : personal information protection
P7 : low price system to authenticate that the data hasn’t been modified

Government Requirements

G1 : Is falsification and modification of medical records clearly prevented?
G2 : Does the patient's disclosure range conform to established laws?
G3 : Are the forms provided by the application standard and well-preserved?
G4 : Easy to access the necessary medical data
G5 : need low price system to manage secure medical data

WinWin Agreement

WWE1 - P6 H2
WWE2 - H3 P5 G1
WWE3 - H1 G2 G3
WWE4 - H1 G2 G3
WWE5 - H2 P6

WWE6 - H4 P2 : If the user accepts the recommendation, the developer receives the advertising fee and the user receives the appropriate medical service and the hospital receives the sales increase.
WWE7 - H5 P3 P1 G4 : Universal and convenient to use anytime, anywhere
WWE8 - H6 P7 G5: can be maintained and utilized in low price