

Geriatric e-Homecare Information System

Lukas¹, Eko Prasetyo Nugroho², Harlianto Tanudjaja³, Kumala Indriati⁴

^{1,2,3,4}Electrical Engineering Department, Faculty of Engineering, Atma Jaya Catholic University of Indonesia

E-mail: lukas@atmajaya.ac.id

ekoset2001@gmail.com

harlianto.tj@atmajaya.ac.id

kumala.indriati@atmajaya.ac.id

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ABSTRACT

According to World Development Indicators (WDI), life expectancy rate in 2019 is the highest in Hongkong with 84.68 years old, followed by Japan with 84.10 years old, while Indonesia ranked 116 with 71.28 years old. Statistics Indonesia (BPS) estimated about 24 million elderly people in Indonesia or 9.3% of the population. However, health facilities for elderly or geriatrics are very limited. One of the important challenges is in maintaining the data, i.e. patient profile, as well as his/her health records. This research in collaboration with the Medical Faculty of Atma Jaya Catholic University of Indonesia (UAJ), has designed and developed a prototype of the e-homecare geriatric information system, with the case of North Jakarta Region. Based on

cloud service, this system is able to maintain patient information, personal health record, which ease the geriatric consultant to deliver better services.

Keywords: e-homecare, geriatric, personal health record

Correspondence:

Lukas

Electrical Engineering Department, Faculty of Engineering, Atma Jaya Catholic University of Indonesia

E-mail: lukas@atmajaya.ac.id

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INTRODUCTION

The positive growth in Indonesia's GDP has resulted in a better health. Having a life expectancy rate of more than 70 years old, this has motivated the medical industry players to provide better solutions for the elderly [1]-[2]. At present, there are very few homecare solutions, they generally only offer periodic medical care services to the elderly who are sick and provide medical equipment rental services such as medical beds or oxygen cylinders. The other needs of the elderly are still generally handled by relatives. But for those who do not have relatives, the elderly will have difficulties for no one will taking care of them. The routine activities of the elderly are generally only remembered by relatives who care for them without being well documented. Problems will arise immediately in caring for the elderly when the caregivers have changed or not present when an accident occurred. Therefore, elderly activities need to be monitored and recorded well, to allow other people giving quick assistance when needed [3]-[4].

In October, 2016, the Indonesian Ministry of Health (MoH) launched a guide book which is titled "Elderly Book" [5]. The book records the elderly's personal identity, personal health log, health state record, health development record, drug use monitoring, and general health information. The ministry provides recommendations for the elderly to have the book and always takes it wherever they go. However, because of the size of the book, people sometimes forget to bring it from home when they leave. People need not only have a media that has a lot of information about their medical condition but also packed in a media which is easily to be carried. Furthermore, this information requires good security, i.e. not easily disseminated and misused by unauthorized people, meets standardized communication protocols, which facilitate the reports recording of many medical applications that needed to provide medical services [6]-[7]. Therefore, the solution to handle the information are needed, and personal health record are introduced.

Personal Health Record (PHR) is an information system which is built as a stand-alone application or as a sub module of e-homecare information system, where health data and other information related to the care of a patient is

recorded and maintained by the patient [8]-[9]. The intention of a PHR is to provide a complete and accurate summary of an individual's medical history which is accessible online. The health data on a PHR might include patient-reported outcome data, lab results, and data from devices such as wireless electronic weighing scales or (collected passively) from a smartphone [10]. Nowadays, some of medical industry players begin to introduce PHR to public, however few of them that have the application. The MoH also does not have a standardization of the PHR yet, which guides the wider use of it.

Homecare is supportive care provided in the home [5]. Homecare is different from Home Health Care which able to provide services by licensed medical personnel. Because of they are non-medical health provider, their services is only about the general needs of the elderly such as bathing the elderly, preparing food, paying attention to the elderly's medication schedule, cleaning the house, caring for the garden, helping to pay bills.

LITERATURE REVIEW

The elderly book which is launched by Indonesian MoH in 2016, has become a standard information related to the care of a patient which is maintained by the patient. This book consists of 6 (six) important personal health topics about the patient. Since it is of paper-based, this information is vulnerable not only to be used by unauthorized people but also easily damaged. Therefore, the need to store information in electronic applications becomes urgent.

PHR was then introduced in seminars by medical industry experts. PHR is defined as a health record which contain all of 6 (six) important health topics and manage by the patient electronically. The PHR is also defined differently from Electronic Medical Record (EMR) and Electronic Health Record (EHR), However there is no definition of standard specification from the ministry of health on how the PHR, EMR and EHR should be in Indonesia. So that, according to The Office of the National Coordinator for Health Information Technology of United States the standard definition is [6]:

Electronic medical records (EMR) are digital versions of the paper charts in clinician offices, clinics, and hospitals. EMRs contain notes and information collected by and for the clinicians in that office, clinic, or hospital and are mostly used by providers for diagnosis and treatment [11].

Electronic health records (EHR) are built to go beyond standard clinical data collected in a provider's office and are inclusive of a broader view of a patient's care. EHRs contain information from all the clinicians involved in a patient's care and all authorized clinicians involved in a patient's care can access the information to provide care to that patient [12].

Personal health records (PHRs) contain the same types of information as EHRs—diagnoses, medications, immunizations, family medical histories, and provider contact information—but are designed to be set up, accessed, and managed by patients [13].

Because of PHR is made electronically, definitions governing the security and procedures of data communication are also needed. The Ministry of Health of Indonesia Republic also does not yet have this definition. At least 47 definitions have been surveyed by [14].

Internet of Things (IoT) or smart devices refers to any object or device that is connected to the Internet. This rapidly expanding set of "things," which can send and receive data, includes cars, appliances, smartwatches, lighting, home assistants, home security, and more [15]. By using the IoT, we can automate patient care workflow such as enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective [16]-[17].

METHODOLOGY

The development of this e-homecare Information System follows the steps illustrated in Fig 1.



Figure 1: Microsoft Sure Step Model

Diagnostic – Filled with discussions to determine the right solution so that it can meet their needs obtain a key understanding of the solution requirements.

Analysis – This phase is defining the activities required to build an effectively plan the entire project.

Design - The configuration of the overall PHR solution needed to satisfy business requirements identified during the Analysis phase.

Development - The goal of the development phase is to build and test the system components defined and approved in the design specifications, including integrations and interfaces and data migration processes.

Deployment - The deployment phase is where all the efforts of the project team come together for a successful implementation to the new PHR Application. The key activities in this phase are End User Training, and User Acceptance Testing.

Operation - The Operation phase defines the activities required to close the project, provide post-production support and knowledge to the user.

The user requirements held on the diagnostic phase which is in collaboration with the geriatric specialists of medical faculty. The observation and surveying on the field took place in the geriatric clinic of Rumah Sakit Atma Jaya (Atma Jaya Hospital), Jakarta. While the analysis dan design, we also having consultation with health-tech player name ProSehat. ProSehat is a health-tech company which focus on marketplace platform, online doctor's consultation, and homecare services.

On the diagnostic and analysis phase, it is suggested and concerned that this application should have some mandatory purpose to comply and standardized the benefits to the community. The MoH and International standardization are some of the compliance that the

application should meet. So that, in this phase, only the PHR will meet the compliance. Others compliance will be added along with further development. The main goals of building this e-homecare application are:

1. Build the PHR module with simple UI/UX design that can be used easily by the elderly or others relatives.
2. The application should comply with MoH and International standardization.
3. Connectivity PHR to EMR and EHR of other applications.
4. Helps the homecare provider to manage the service easier.

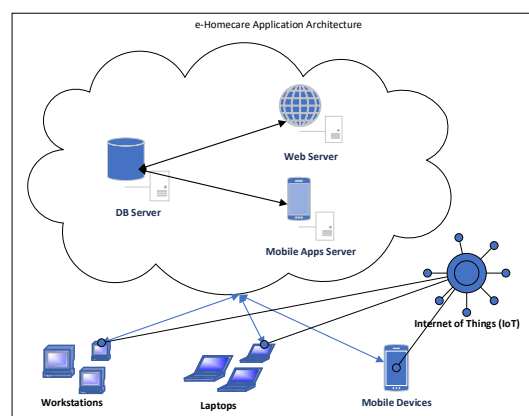


Figure 2: e-Homecare Application Architecture

e-Homecare Information System is an application for homecare provider which is categorized as non-medical health provider. So that e-Homecare Information System able to manage PHR as long as the patient give permission to the provider. This system is designed with cloud-based application using the interface of web and mobile apps. There also have APIs as connector to communicate with

other application, smart device or IoT products [18]. E-Homecare application can be seen in Figure 2.

RESULTS AND ANALYSIS

This phase of development has defined PHR, EMR and EHR as describe on Figure 3. The Medical Health Providers (MHP) such as Hospitals, Clinics, Puskesmas have the most privilege because they have permission by law not only to manage EMR, EHR but also view and synchronized the PHR data into EMR or EHR to enriching its information. The ability to synchronized between PHR, EMR and EHR is indispensable since the MHP having many daily outpatients. It helps stakeholder reducing lots of time to exchange and manage the information. In most country, Health Level Seven International (HL7) is the compliance that manage this communication. This protocol is one of the mandatory compliances if the application wants to be commercialized publicly. The PHR basically is manage by patient, in this case the elderly. However, in most case of very old elderly or whom

have illness severely, they were unable to manage the PHR by themselves. Thus, the elderly usually granted relatives, if there are still any, to manage it. Otherwise, the non-medical health provider (NMP) will be the last party to help.

There is some information that will interchangeable when the PHR synchronized with EMR or EHR (see Table 1). Firstly, the biodata, it is very helpful when the elderly enters the MHP first time. The MHP operator don't need to filling the application by typing. The Personal Health Log (PHL), Health Development Record (HDR) and Prescription Log also has copied automatically into Clinical Notes and HDR for the first time. Thus, will help the medical doctor diagnose the patient. If, the MDP do lab check or radiology scanning, the eligible result will be saved to the PHR. Last, the Medical Resume along with the new prescription will be transferred into PHR. The Medical Resume stored into Medical Resume in PHR, the new prescription stored into prescription log in PHR. The information of Diagnosis is unable to be transferred due to protection by law.

Table 1: Differences of PHR, EMR and HER

Differences of PHR, EMR and EHR		
PHR	EMR	EHR
Manage by Patient	Manage by Single Health Provider	Manage by Multiple Health Provider
Personal Identity Biodata Family/Relatives Information	Personal Identity Biodata Family/Relatives Information	Personal Identity Biodata Family/Relatives Information
Personal Health Log**** Family Background Work Experience Family Genetic Health Record Allergies Home/Environment Information Immunization Illness Record Surgery Record Hospital Inpatient Record Homecare Record Daily Habitual Dietary Habit Daily Social Activity Physical Statistic Mental Condition Fitness Level Collapse Risk Level Nutritional Assessment Autonomy Level	Clinical Notes**** Family Background Work Experience Family Genetic Health Record Allergies Home/Environment Information Immunization Illness Record Surgery Record Hospital Inpatient Record Homecare Record Daily Habitual Dietary Habit Daily Social Activity Physical Statistic Mental Condition Fitness Level Collapse Risk Level Nutritional Assessment Autonomy Level	Clinical Notes**** Family Background Work Experience Family Genetic Health Record Allergies Home/Environment Information Immunization Illness Record Surgery Record Hospital Inpatient Record Homecare Record Daily Habitual Dietary Habit Daily Social Activity Physical Statistic Mental Condition Fitness Level Collapse Risk Level Nutritional Assessment Autonomy Level
Health State Record		
Health Development Record* Physical Statistic Mental Condition Fitness Level	Health Development Record** Physical Statistic Mental Condition Fitness Level	Health Development Record*** Physical Statistic Mental Condition Fitness Level
Lab Reports* Blood Lab Radiology	Lab Reports** Blood Lab Radiology	Lab Reports*** Blood Lab Radiology
Drug Monitoring Prescriptions Log* Drug Use Log	Drug Monitoring Prescriptions Prescriptions Log**	Drug Monitoring Prescriptions Prescriptions Log***
	Diagnosis	Diagnosis
Medical Resume*	Medical Resume**	Medical Resume***
General Health Information		

Notes:

- * The log/historical from all over provider that patient visited
- ** The log/historical only from single provider
- *** The log/historical from organized several provider
- **** Generally the clinical notes contain portion of PHR and detailed activities of the provider that occur when the provider treats the elderly

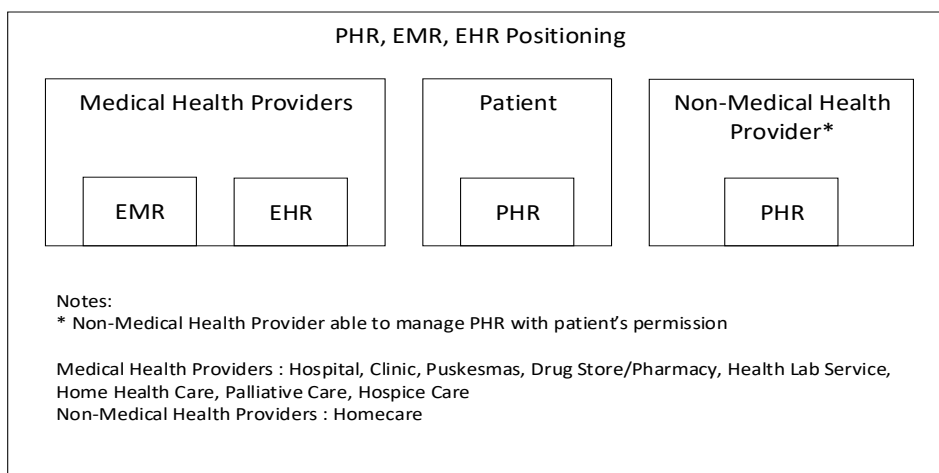


Figure 3: PHR, EMR, EHR Positioning

The application has developed, tested at the Cognitive Engineering Research Group laboratory and was implemented in Geriatric Clinic of the Rumah Sakit Atma Jaya. The user were divided into two groups, the patient and the NMP. The NMP is also divided into some specific users, e.g. as administrator, management, finance, administration,

HRD, caregiver, driver, and gardener so that the segregation of duty feature is applied.

It also has implemented to recording 24 real PHR patients where 10 patients are male and 14 patients are female with successfully result. The implementation were tested using several scenarios by various patients' data. Application view of Homecare can be seen in Figure 4.

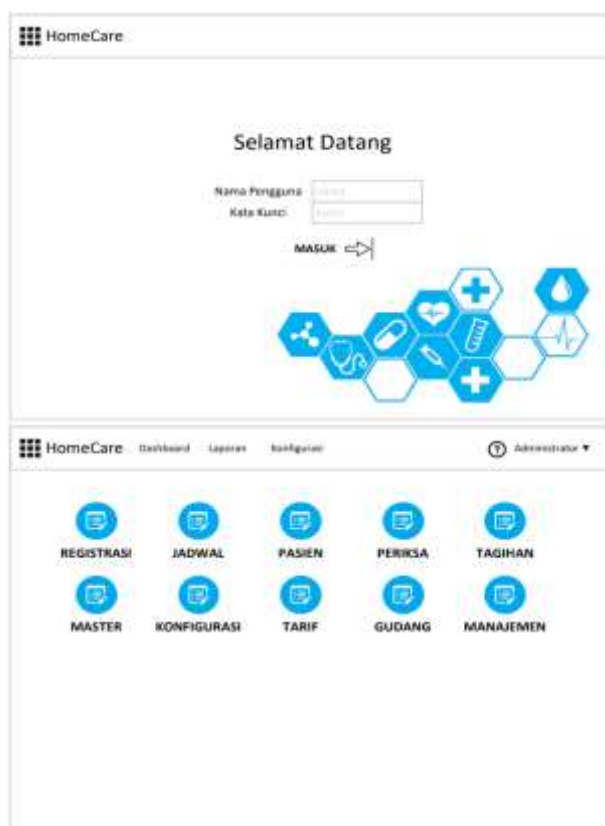


Figure 4: Application View

CONCLUSION

The e-Homecare Information System is very helpful for homecare provider and elderly, i.e. the application eases both stakeholder to synchronize the PHR. This application also helps the provider in order to reference it to the medical health providers. However, this prototype needs further

enhancement toward commercial readiness. This phase only develops PHR and some basic fundamental operation of homecare services. There are still many enhancements that can be added into this software such as HL7 protocol compliance, IoT API to collaborate with IoT device, email notification and reminder to stakeholder.

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