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# Analysis and Design of Web-Based Health Service Information Systems (E-Health), in the Industrial Revolution Era 4.0

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**Abstract.** This research is motivated by an analysis of the need for a health service information system which is an important part that cannot be separated from the health system in a country. This study aims to provide fast service information to the public and can increase the role of health care institutions through the provision of information about health complaints that occur in the surrounding environment. Especially in the era of the industrial revolution 4.0 which is also known as the digital era, where many sectors of life are inseparable from the participation and use of computer technology. Community Health Centres (Puskesmas) is one of the health service centers at the sub-district level. The number of patients is quite large, causing problems in getting information about the patient, the number of patients, the number of visits, total income, data on drug supply and drug data that has been used by the puskesmas. Based on the existing problems, it is necessary to design a web-based health service information system using the PHP and HTML programming languages and MySQL as its storage media or database. The system development methodology that I use is the prototype methodology. The result of the development of the system is that the system can help the Public Health Service Center to manage existing health services, especially helping the community to obtain important information about health services.

## 1. Introduction

Industrial Revolution 4.0 all aspects of human life are always related to technology. Various facilities are presented through various fields of application. In line with developments, the health service sector must also follow technological developments [1]. For this reason, all human resources in the health sector must be technology literate so that they are not obsolete. In order to improve health services to the people of Indonesia, there must be innovations that are able to build an integrated ecosystem, called e-health. Everything must be based on technology that is sure to make it easy for anyone [2], [3] Health Information System is one important part that can not be separated from the Health System in a country [4]–[6].

The world is entering the era of the Industrial Revolution 4.0, an era that is a period of new development when several technologies including physical technology, digital technology and biological technology have each achieved unprecedented developments in their respective fields. These three technologies are the main or most fundamental technology drivers for the Industrial Revolution 4.0 [7]–[13]. This technology is very closely related to the world of health. The advances that have been



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achieved in the Industrial Revolution 4.0 era are reducing costs, increasing the ease and efficiency in technology and genetic sequencing, activation and editing [14].

Progress or deterioration of the Health Information System is always correlated and follows the development of the Health System, the progress of Information and Communication Technology and even affect the Government System that applies in a country [15], [16]. A system that is conceptualized and well structured will produce good output as well. Health information system is one of the main forms of the National Health System which is used as a basis and reference in the preparation of various policies, guidelines and directions for the implementation of health development and health-oriented development [17]. With a good health information system it will make the public not blind with all health problems. And want to bring his family to seek medical treatment easily, no longer with a complicated bureaucracy that makes people reluctant to bring their family members to seek medical services provided by the government [18]. With the proliferation of media and technology development, it should make the public and especially public health students literate about the progress of innovating on Indonesia's health information system.

The Health efforts organized at the Community Health Centres (Puskesmas) consist of Mandatory Health Efforts and Health Development Efforts. Health Efforts Must Provide Very Big Leverage on the Success of Public Health Development through Increasing the Human Development Index, Health Development Efforts are health efforts that have been determined based on local community health problems and adjusted to the capabilities of the Community Health Centres (Puskesmas) including dental and oral health efforts, mental health efforts, eye health efforts, fostering traditional medicine, and public health care [19].

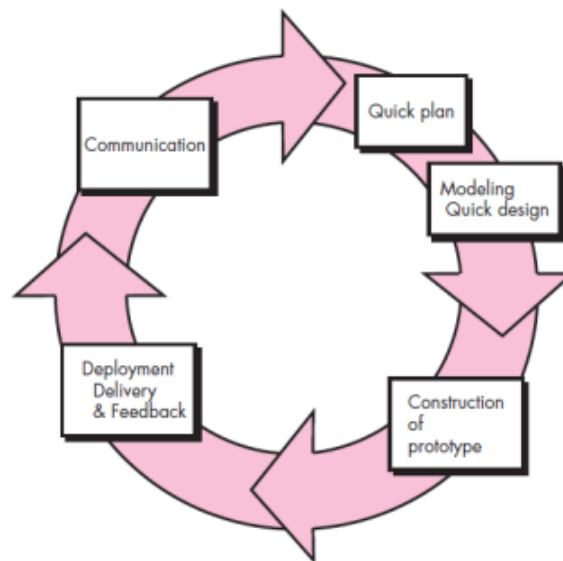
The health service information system is an important part that cannot be separated from the health system in a country [20]. With the availability of the information system, the public can get health services quickly from various existing health institutions, and can increase participation through providing information about health complaints that exist / occur in the surrounding environment [21]. Especially in the era of the industrial revolution 4.0 which is also known as the digital era, where many sectors of life are inseparable from the participation and use of computer technology. Increasingly, advances in computer technology, both in the field of software and hardware are growing rapidly and are also developing towards the ease of applying it [22], [23].

The Sitiung I Health Center, which is one of the health service centers in Sitiung Subdistrict, Dharmasraya Regency is one of the health agencies that is being developed. With a large number of patients causing quite severe problems in getting information about their patients, patient visits, patient medical records and drug data that has been used by the Community Health Centres (Puskesmas). In addition to the issue of patient data collection and archiving of medical records is an important thing that needs attention [24]. Moreover, in the Community Health Centres (Puskesmas) the data collection of patients, from the start of patient registration and archiving of patient medical records is still done manually, meaning that everything is still written on paper piles and stored on storage shelves, so that when the Community Health Centres (Puskesmas) requires patient data, reports visits, and also reports on the data of medicines that have been used, it takes quite a long time to find where the data is stored.

Create patient data collection, archiving medical records and drug data in an orderly and good manner, good management is also needed from the department that handles it. Apart from operational technical issues, good management of patient data in a public health agency can be determined from its administrative mechanism [22]. Good administrative mechanisms will create convenience and efficiency in the process of recording and retrieving information. With this ease and efficiency, it is expected that the available information can be used optimally, processed in such a way that it will be very helpful in determining the medical actions that must be taken.

## 2. Method

The system development method used by the author is to use the prototype method as a method of development with the existence of several advantages and in accordance with the problem that the author wants to raise. the manufacturing process as shown in the figure 1.



**Figure 1.** Prototype Model

Development of information systems requires an analysis of the reasons for ideas to develop information systems. Analysis was carried out to see the various components that were running including hardware, software, networks, and human resources. System requirements analysis must define specific system requirements, i.e. input, output, process, source of data handled and control [25].

The system requirements analysis phase requires an evaluation to find out the system's ability by defining what the system should be able to do then determine the criteria that the system must meet. Some criteria that must be met are the achievement of objectives, speed, cost, quality of information produced, efficiency and productivity, accuracy and validity reliability or reliability [26]. System design determines how the system will meet these objectives. The system design consists of design activities that produce functional specifications. The design the system can be seen as an interface, data and process design with the aim of producing specifications that fit the product and user interface method, structure database and processing and control procedures. The prototype software package is tested, implemented, evaluated, and modified repeatedly until it is acceptable to the user. System testing aims to find errors that occur on the system and make system revisions. This stage is important to ensure that the system has been made error free.

After the prototype is received, this stage is the implementation of the system that is ready to operate and then the learning process occurs for the new system comparing it to the old system, evaluating it technically and operationally and interacting users, systems and information technology.

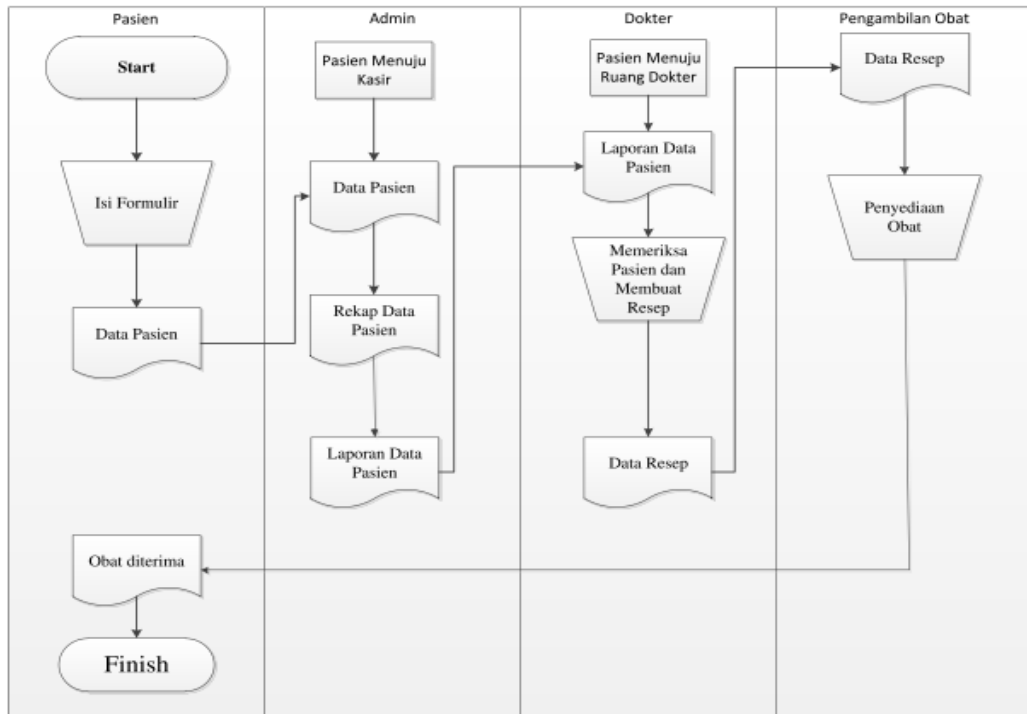
### 3. Result and Discussion

#### 3.1 Analysis of Current Information Systems

Each system that runs generally has a system boundary (boundary) that separates the sub-system itself from the environment outside the system. Limitation of a system also shows the scope of the system itself. The environment of a system can be beneficial or detrimental, this also becomes one of the tasks of the system boundary in order to maintain a favorable environment outside the system and avoid adverse environment outside the system. If the input to the system is good, the output produced will be good.

Puskesmas Sitiung has many operational activities, including patient outpatient registration, checking medical records, doctor actions to patients and diagnoses, prescribing drugs, payments and so forth. Based on this, it is necessary to limit the system to be researched so that the research process becomes more focused. data collection and drug administration, the researcher will limit the information system about the patient id number, patient queue number, inputting patient data, inputting patient

complaints, inputting patient diagnoses, inputting types of drugs for patients, as well as transaction costs carried out by patients as well as making patient data reports periodically, as shown as figure 2.



**Figure 2.** Flow of Information System (Old)

In the information system for registering and registering outpatients at the current Sitiung Community Health Center, there are advantages and disadvantages, among others: The advantages, namely with this proposal system, officers can easily obtain patient data quickly because they do not need to search for ledgers and piles of maps, can also save time and use of paper because doctors' prescriptions and drug data for patients have gone through the system and the pharmacist can see the doctor's prescriptions and diagnoses clearly on the system. The drawback, namely for all outpatient processes, patients still use manual methods and recording in the ledger and the data processing is not quickly resolved.

*3.2 Control Analysis*

In the Outpatient Patient Reservation Information System process at the Sitiung Community Health Center, a control is needed that functions as a control, so that the data entered, output and process are valid. While controlling the current system that is used is still using the manual method, this control is still done by looking at the notes in the ledger and to obtain information the file is still in physical form. The existence of the characteristics that are still manual can make information slow and the possibility of errors in inputting data so that it can result in a process of repetition in inputting the data. So that it is felt in this control is still very simple that is done by checking in a file cabinet stored in a folder that the possibility of control is not right because there is a risk of data loss and data damage, because the data is physically in the form of paper then there is a possibility that the data will be damaged and dirty.

*3.3 System Requirements Analysis*

Based on the results of research that has been done, where in the provision of inpatient information requires quite a long time in collecting data and services to patients. Therefore, we need a software (software) to obtain information about patient data for it is made an Inpatient Services Information System application to facilitate the clinic and as a patient care facility. Development of the current system is needed so that it can produce reports that are reliable, simple in presentation as well as accurate, fast and better information systems so as to be able to facilitate work quickly resolved so that

the work deadline will be quickly resolved because it is easy to get information and not need to delay work due to lack of a fast and accurate information system.

A system can run optimally, it will affect the quality of performance in doing the work, then it happens that the system can run in accordance with expectations, among others: Outpatient system activities have been computerized so that the data input process will be quickly resolved and the data storage has been computerized using a database MySQL as a security for storing a data and as a data bank. Making it easier to control the checking of the patient's medical record file will be more effective and efficient and provides convenience if one day an error occurs in the data it will be quickly detected so that the error quickly in the process of solving problems that occur. The system uses the PHP programming language. Displays periodic patient data reports. The resulting display is user friendly that is easy to use and understand by users.

3.4 Proposed New Procedure

The computerized system is a support in an installation, savings in terms of time, energy, costs will be felt. The data to be used will be processed and stored in a structured manner, which can speed up the processing of large amounts of data. Information systems in an organization are limited by data that can be obtained for procurement, processing and distribution. Information through a computer system proposed by the author for use by employees, especially doctors and the medical records section of the Sitiung Public Health Center, in carrying out its activities is greatly supported by the accuracy of the incoming data. In this case a computer information system is a system that supports the achievement of maximum targets, as shown in figure 3.

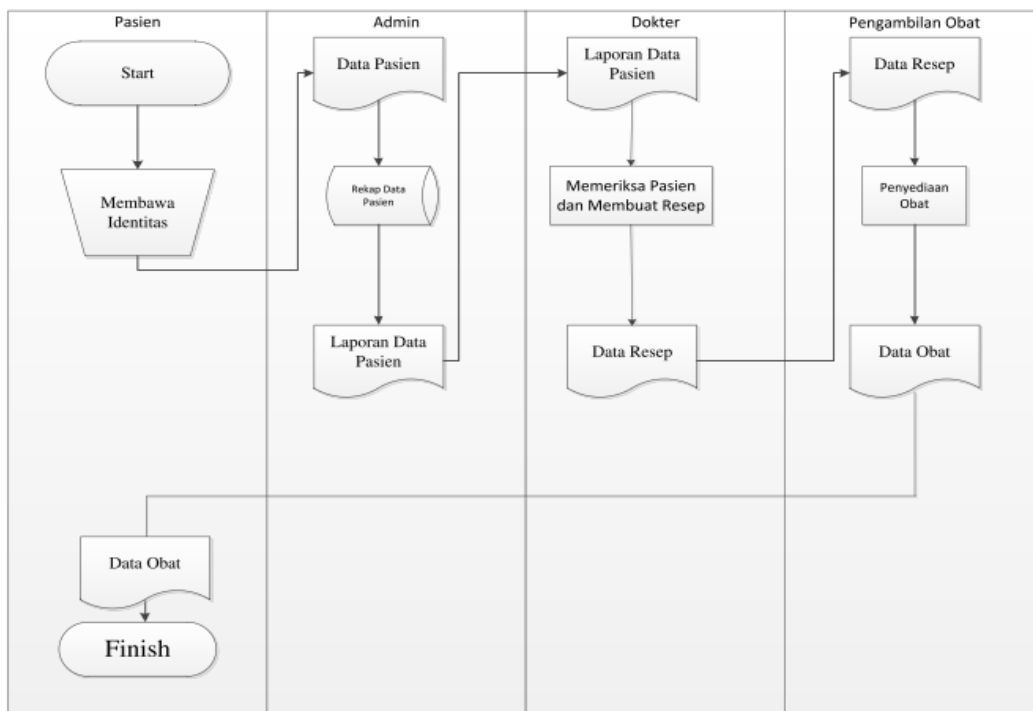


Figure 3. Flow of New Information Systems (New ASI)

3.5 System Design Results

Admin must login first to be able to manage and manage data in the admin page. System Testing is the first to enter the Simpuskesmas website, then the user must fill in a username and password like Figure 4.



**Figure 4.** Login page menu

This page is for registering patients to the Puskesmas services to be addressed, by searching the medical record number and patients already registered at the Puskesmas will enter the queue based on the intended Puskesmas services, as shown in Figure 5.

DATA PENDAFTARAN		DATA PASIEN	
No Rawat	<input type="text" value="2020-06-18-0001"/>	No Rekamedis	<input type="text" value="Masukkan No Rekamedis"/>
Dokter Penanggung Jawab	<input type="text" value="Dokter Penanggung Jawab"/>	Nama Pasien	<input type="text" value="Nama Pasien"/>
Poli Tujuan	<input type="text" value="--Silakan Pilih--"/>	Tanggal Lahir	<input type="text" value="Tanggal Lahir"/>
<input type="button" value="Tambah"/> <input type="button" value="Kembali"/>		Nama Penanggung Jawab	<input type="text" value="Nama Penanggung Jawab"/>
		Hubungan Dengan Penanggung Jawab	<input type="text" value="Saudara Kandung"/>
		Alamat Penanggung Jawab	<input type="text" value="Alamat Penanggung Jawab"/>
		Status Pasien	<input type="text" value="Pilih"/>
		No BPJS	<input type="text" value="No BPJS"/>

**Figure 5.** Patient registration menu

### 3.6 Service Menu Page (Patient Services)

This page is for entering disease diagnosis data,. The results of the examination will be inputted on this page, the data inputted include the name of the disease, characteristics of the disease, special and general information, as shown in Figure 6.

Figure 6. Disease diagnosis data input menu

The Doctor Data Report Menu is one of the external pages in the Puskesmas service information system shown as figure 7. This page will contain a doctor's bio. A printed menu is also available on the doctor data page, paramedical data, position data, field data and poly.

Laporan Data Dokter							
Kode Dokter	Nama Dokter	Jenis Kelamin	Nomor Induk Dokter	Tempat Lahir	Tanggal Lahir	Alamat	Nama Poli
IA-0	Fitri	Perempuan	4929029033291	CIREBON	26-08-1995	Kalimalang	POLI KIA
K-02	Sunarya	Laki-Laki	71816828738790	Majalengka	12-07-1977	Sukaluyu	POLI UMUM
K-12	Karsa	Laki-Laki	71816838738718	Sidoarjo	15-06-1982	Adiarsa	POLI GIGI
S-23	Samsul	Laki-Laki	48916838738757	Climahi	26-11-1993	Ciraos	POLI GIGI
S-24	Maryudi	Laki-Laki	71816838888718	Cepu	21-08-1993	Santiong	POLI UMUM

Figure 7. Doctor Data Report Menu

Different Test, Old and New System Provide an assessment of several aspects of information quality before and after the old and new puskesmas information system. To find out the success of the system that has been applied has also been measured the performance of the old system and the new system, while the measurements were carried out on system performance by using a check list. The results of measurement of information quality before and after measurement of information systems can be seen in the Table 1.

Table 1. E-Health information quality measurement results

Criteria	Information System of E-Health (Old)		Results of E-Health Development		Difference
	Component	Average	Component	Average	
Relevan	4	1,56	4	3,49	1,93
Accuracy	4	1,48	4	3,68	2,20
Time	3	1,53	3	3,74	2,21



Equipment	3	1,75	3	3,82	2,07
Average		1,58		3,68	2,10

Based on the evaluation results of the weighted average value of relevant criteria, before the development of the system 1.56 and after the development of the system 3.49 based on these values it can be concluded, the relevance of the information generated, after the development of the system is better than before the development of the system with a weighted average difference is 1.93.

From the assessment items relevant, accurate, timely, and completeness of the difference in the highest weighted average value is the timely and accurate criteria with a difference of 2.21, this shows the timeliness and accuracy of obtaining reports before and after the development of the system is strongly felt by the user.

### 3.7 Sign Test

Test the difference between the old system and the new system is done for each observation, the difference test is calculated with SPSS data used for the different test is a weighted average.

**Table 2.** The result of sign test

Variable	p
Analysis of differences in the evaluation of the performance of the old system and the old system	0,0002

The results can be seen in table 2 that is for the 2-way sign test obtained  $p = 0.002$  means  $p < 0.05$ . There is a significant difference between the old system and the new system. This condition is caused by the officers in getting more relevant, complete, accurate and timely information by using the new system compared to the old system.

Puskesmas information system can present daily, monthly data, however researchers realize there are still limitations to the developed drug information system, including: Reports generated are still new Puskesmas and inpatient service reports, can still be developed for reports on inpatient drug distribution Street. Reports generated can still be developed for reports on the costs of care and handling of inpatients receiving medical support services. With the ease of obtaining information, the puskesmas information system is beneficial for management in monitoring services at the puskesmas, ranking of drug use from the most used to the least used, distribution of drugs per inpatient, unit price of drugs per inpatient and the total price of the drug per inpatient.

The implementation of health services that use digital media is not limited by place, so it is not impossible that health services especially those that are promotive and preventive are carried out not in health facilities such as Puskesmas but in Village Centers, Lurah Offices, Camats, Green Open Spaces, Patient Homes and so on . Both of these will be able to help reduce the need to increase the quantity of health service facilities, so that existing funds can be more utilized to improve the quality, existing facilities and infrastructure.

## 4. Conclusion

The creation of an online examination system is an online testing tool for optimizing exam activities. The online exam system provides benefits, including not needing to duplicate test papers and saving time for examination corrections.

The making of a Computer Base Test is an online testing tool for optimizing exam activities. The Computer Base Test system provides the benefit of not needing to duplicate test papers and saving time for examination corrections. The random function of the questions on the online examination system can reduce the cheating committed by examinees because the questions presented vary so that the examinees will receive different questions from one another.

Examination, mainly based on the Computer Based Test, can be done with this information system. It is necessary to adjust and socialize the application of this Computer Base Test information system. Cooperation between the stakeholders in the University is carried out to support the implementation of the information system that has been developed. For the next development so that the information

system that is designed to provide maximum results and features.

**Implications and Future Development** The use of technology especially in the medical field in the form of digital health needs to be developed so that it can be more useful for many people. Collaboration and cross-sectoral support from the Government, Professional Organizations, Universities, NGOs, the private sector and the community are needed and will determine the success of digital health applications in Indonesia. This collaboration can start from the preparatory stage such as making guidelines, providing funds, equipment, trained resources to the implementation stage such as the installation of a digital health system especially in areas where access to health services is still limited.

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