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Research Article

Prototyping an Online Patient Registration Based on a Smartphone App at the Malang Primary Health Care

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Abstract.
Currently, the patient registration system at the Primary Health Care (PHC) in Malang City still uses a manual registration system with various existing problems, like the emergence of queues and patients jostling in the waiting room, so it takes longer for health services. This study aimed to design a prototype application for online patient registration at the Malang City Health Center. The method used is Research and Development Prototyping. The manufacturing stages start from (1) the identification of basic needs, (2) developing a working prototype, (3) using a prototype (trial), and (4) revising and improving the prototype. The instrument used in this study was an interview guide conducted with two Heads of PHC (Dinoyo and Rampal Celaket) and nine Registration Officers at two Health Centers to determine the need for designing a prototype online registration application. Observations were made regarding the existing IT systems (Hardware and Software) in both PHC, the facilities and infrastructure that support IT systems (rooms, internet networks, etc.) and the documents supporting the processes. The results of this prototype design were in the form of a list of functional and non-functional requirements, business process flow diagrams, data flow diagrams, Entity Relationship Diagrams, and Interface Design, including programming language and user interface. Based on the results of the online patient registration prototype design, it enters the initial stage of using a system design that is by user needs but has yet to reach the implementation stage. However, this prototype can be used as a reference in developing an integrated online registration system with existing information systems at the PHC.

Keywords: Prototype, Online Registration, Smartphone, Primary Health Care, Patient

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1. INTRODUCTION

Health services in the 4.0 era aim to provide innovative and qualitative services using sophisticated technology (such as *Machine Learning, Internet of Things* sensor equipment, social media), which can be accessed easily, simply, according to individual needs, can provide health information so that support active and healthy lifestyle and behavior changes. Digitalization of health services 4.0, through improving technology both from the social aspect and human resources will provide quality health services (1) .

One form of digitizing health services is the existence of an online registration or scheduling system for patients. Many studies have been conducted including web - based scheduling. The results showed a positive change after adopting web - based scheduling. These changes include reducing the average absence to register directly, reducing the number of employees, reducing waiting times and increasing patient satisfaction (2) . Another study showed that there was a significant positive effect on patient waiting time (38.2 min before vs. 23.8 min after intervention), mean absenteeism for in-person enrollment (25% before vs. 11% after intervention), and timeliness of physician services (−30 min before vs. -14.2 min after intervention) (3) .

Online registration allows patients to make appointments independently. The results showed that the number of independent registrations increased significantly (29.5%), because it can be done outside the working hours of the registration officer so that it adds a value of convenience for both officers and patients. The study also showed that 93.1% of patients (712/765) were able to schedule in 1 stage. Besides that, self-registration can reduce the amount of time required by registration officers to provide registration services (4) .

The results of another study show that users of mobile health applications have better experiences regarding communication between doctors and patients, access to information, payment of medical services fees, short-term impact and general satisfaction. The study also found that users of mobile health applications are young, have better education, live in urban areas and require specialist services.

Mobile health applications can save patients time during their visit. After selecting the type of service needed, patients can monitor the queue on the mobile health application and arrive at the health care facility just before their turn for the appointment. Patients can also use mobile health applications to pay for their medical expenses without waiting in line after completing medical check-ups and diagnostic procedures (5) .

Mobile health applications is very dependent on the situation and conditions both in terms of patients and health service providers in its implementation. These include access to the internet, readiness for new systems, computer literacy, experience with internet-based health services, patient habits, cost, flexibility, security and integrity.

The results of a study conducted at a Community Health Center, rural South Coast, Australia recommended against using online appointments for the majority of the patient population due to lack of access to the internet, lack of readiness of new systems, low computer literacy, lack of experience with internet-based health services, and incompatibility of patient care with the patient's habits in making appointments. Health

care providers need to consider general public acceptance of online health services before implementing more complex consumer health services (6) .

Cost, flexibility, security and integrity are the main reasons that prevent health care providers from using web-based scheduling. Patients' reluctance to use web-based appointment scheduling is primarily influenced by past experiences with computers and the internet, as well as their choice of communication (2) .

Malang City Health Office data states that there are 16 Puskesmas in Malang City. Several Puskesmas have implemented online registration . Some health centers use the mobile JKN application and some use the Whatsapp method , however, there are still queues in the waiting room which are at risk of causing the possibility of exposure to infection between officers and patients and patients with patients. Research conducted previously to analyze the readiness to apply online registration at the Malang City Health Center, based on the Likert scale, showed that the average results of PKM Heads (4.2), medical record officers (4.15) and patients (4.18) were ready to use registration. on line. In terms of PKM, this study shows that 100% of PKM in Malang already have Human Resources (Man), there are more than 50% of PKM that already have a policy on online registration (Method/Policy), 100% PKM has an operating system and application (Materials/Software), 100% PKM already have a capable computer (Machinery/Hardware), 100% PKM already has financial support. This study concludes that PKM (Head of PKM and RM Officer) and users (patients) are ready to carry out online registration although method/policy support is still needed from the authorized party (7) .

Based on this background, the researchers are interested in designing an online registration application at the Puskesmas in Malang City in the face of changes in the registration system that are more effective, efficient and reduce contact between patients and medical record officers.

2. MATERIALS AND METHODS

This study uses a research and development design with a prototyping model system development method. The application was then developed based on the findings of the problems found in the field and took references both from the literature and from research subjects. Research on the design of an online registration application prototype was carried out in 2 (two) Public Health Centers in the city of Malang. The time of the research starts in January - December 2022. In designing this application the prototyping model method is used, namely the process of designing a prototype then demonstration and testing and evaluation are carried out. There are several stages

in application design with a prototyping approach. Prototyping is divided into 4 stages, namely Identify basic requirements (Identify basic needs), Develop a working prototype (Develop a working prototype), Use the prototype (Use the prototype), Revise and enhance the prototype (Revise and improve the prototype) (8) . The subjects of this study were the Department of Health and 2 (two) Public Health Centers in Malang City. The research subjects used purposive sampling and were selected to represent 1 inpatient health center and 1 outpatient health center. Data collection techniques consisted of in-depth interviews (indept interviews) and observation. Interviews were conducted with the Head of Division and Holders of Health Service Programs at the Health Office, Head of Puskesmas and Registration Officers at Puskesmas in this study, which were related to the existing IT system (Hardware and Software) at the Health Center, facilities and infrastructure that support IT systems (rooms, internet network, etc.) as well as documents that support the processes in it. The data collection instrument consisted of an in-depth interview guide and an observation checklist. The interview guide used in semi-structured form contains questions to be asked related to the need for designing an online registration application, as well as other required information. The observation checklist is a guide for making observations related to existing IT systems (Hardware and Software) at the Public Health Center, Facilities and Infrastructure that support IT systems (rooms, internet networks, etc.).

3. RESULTS

3.1. Analysis Needs Design Get up Application Online Registration

Information systems are needed to support the achievement of performance indicators, especially in the registration section. Currently PKM Rampal Celaket uses the Ms. Excel to enter patient data at the time of registration. Meanwhile, PKM Dinoyo still uses the manual method to register general patients and the PCare application which is an application for BPJS participants. Based on information from informants from the 2 PKMs, it is known that there is no special information system used in the patient registration system. Previously in 2019 there was an application provided by the Public Health Office, namely the Generic Sikda, but it is no longer used. PKM Rampal Celaket using the Ms. Excel since not using Generic Sikda. Meanwhile at PKM Dinoyo, Generic Sikda can only be used as a database and store because it cannot process data.

The medical record numbering system used in both PKM is a family folder system. This means that 1 medical record number can be shared by the patient and the patient's

family. The informant also stated that the data needed was the patient's social identity consisting of Name, Address, Date of Birth, KTP and BPJS. In addition, to be able to achieve the indicator, it is necessary to have a clickable time stamp from the beginning of registration to the completion of service delivery so that it can record the time needed when serving patients.

Based on the references and analysis of PKM Rampal Celaket and PKM Dinoyo, an analysis of the functional and non-functional requirements of the system can be made.

TABLE 1: Functional Requirements Analysis Table.

No.	Functional Needs
1.	Patients can input their NIK/KTP at the beginning of the online registration page
2.	Patients can input social data and poly goals at the puskesmas
3	Patients can see their registration history
4	Registration Officer can login to the application
5	Registration Officer can input registrant data
6	Registration Officers can view registrant data online and change their status
7	Registration Officers can view registrant data and can perform update and delete operations on data

TABLE 2: Table of Non-Functional Needs Analysis.

No.	Non-Functional Needs
1.	Application comes with security
2.	The application is developed based on the website
3	The user interface is made responsive so that it can be opened on all devices
4	The application uses a system that is easy to use by users and simple
5	Database storage via My SQL
6	Can be used in any browser
7	Bootstrap-based app colors and fonts

3.2. Design Application Online Registration

3.2.1. Business Process Design

The system flow chart in fig.1 is a diagram that describes the online registration flow carried out at the puskesmas. In the first step, the patient is asked to input an identity card. After that the system will look for a suitable identity. If the identity is not found and has not been filled in, it means that it is necessary to fill in the patient's social data
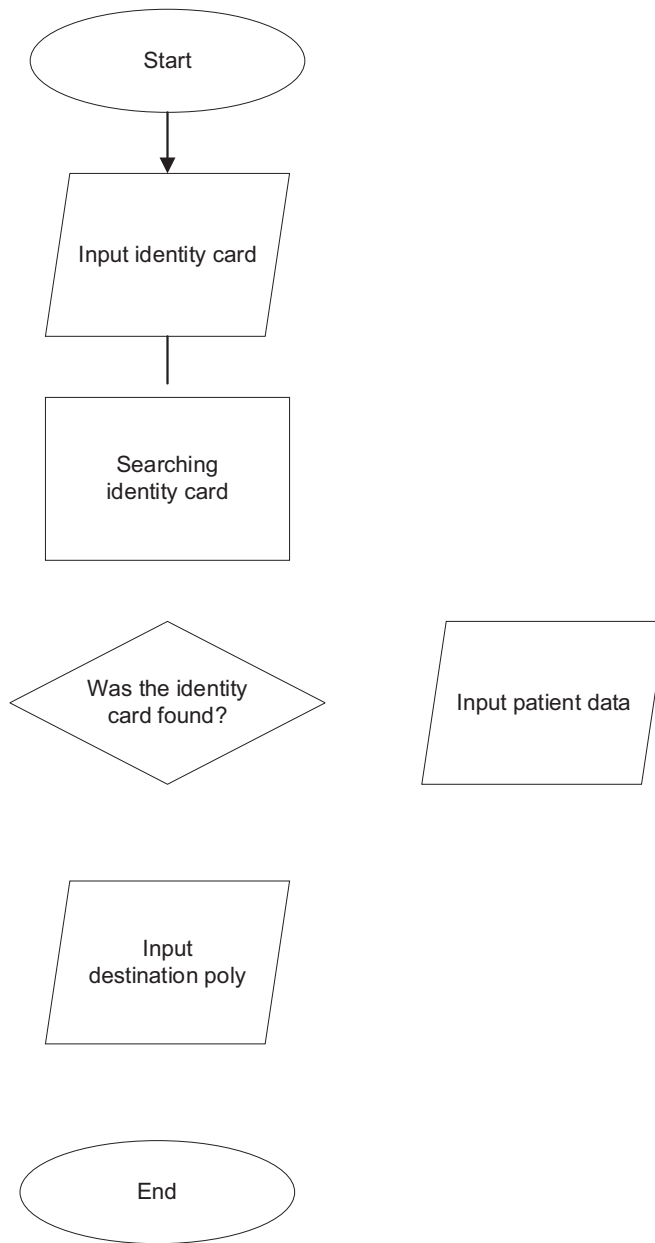
Figure 1: Flow Chart System Application Online Registration.

to be completed, however, if the identity card is found, the social data will immediately appear which can be changed. If you have finished filling in the patient's social data, continue to fill in the destination poly. After that the form can be submitted to register online.

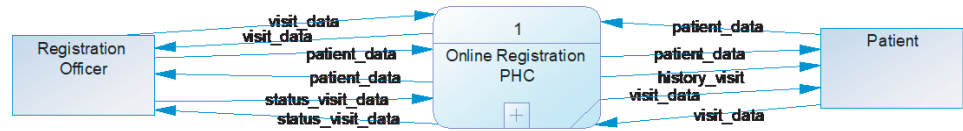### 3.2.2. DFD Design

a. DFD Level 0

Figure 2: DFD Level 0 Application Online Registration.

This DFD describe the outline user application online registration. There is two DFD, namely DFD level 0 and DFD level 1. DFD 0 describes context from the process as well entities that have lines in the form of input and output data whole. On app this there are 2 entities main that is officer registration and patient.
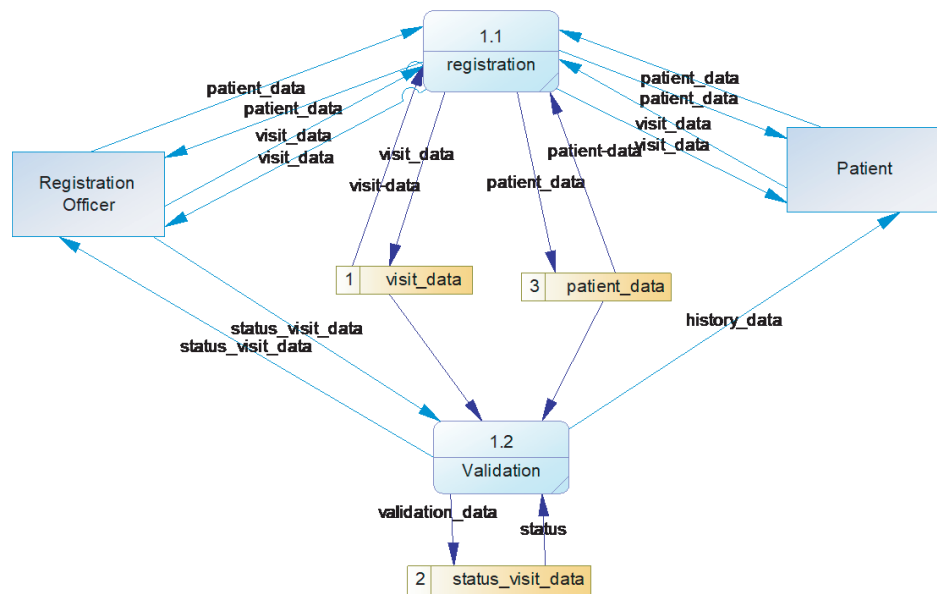
b. DFD Level 1

Figure 3: DFD Level 1 Application Online Registration.

DFD level 1 depicts data flow in the application online registration. Connected data stream to deposit depicted in fig. 3. Data flow starts from the registration process where each input and output is carried out by the entity officer registration and patients. From the registration process the data is stored to storage visit_data and patient_data. The second process is validation carried out by officers registration. Patient will get history from validation by officer registration after dating _ health center. From the validation process the data is stored in storage status_visit_data .
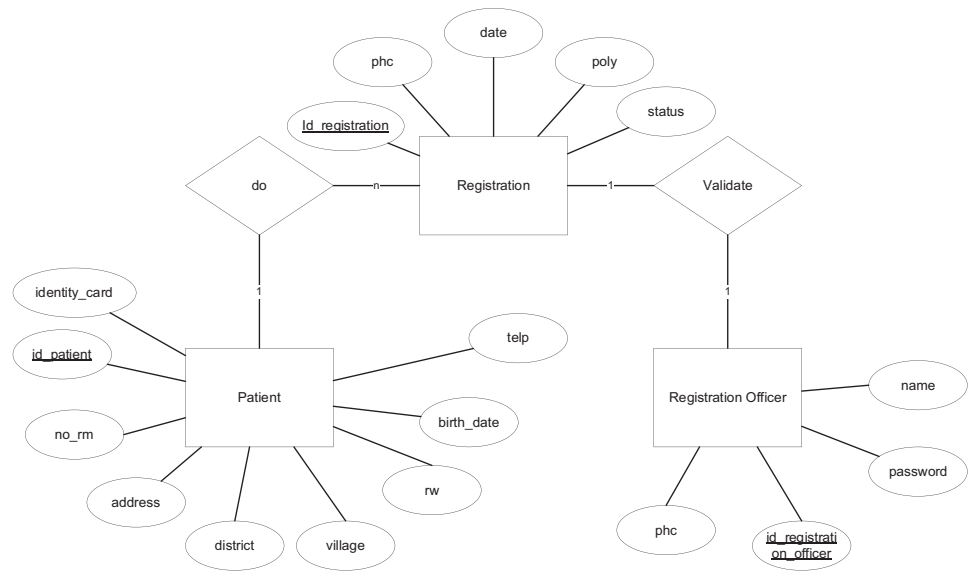
Figure 4: Application ERD Online Registration.

3.2.3. ERD Design

Fig 3 depicts connection between entity along with the attributes it has on the application online registration . There are 3 entities main in the ERD that is Patients , Registration and Officers Registration . On each entity there is accompanying attributes . _ Entity Patient have attributes : identity card as primary key, id_patient , no_rm , address, district, village, rw , birth_date , and tel . The attribute on registration has id_registration as primary key, phc , date, poly, status. Then the registration officer has attribute id_registration_officer as primary key, name, phc , password. There is relation Among patient and registration with one to many cardinality . One to many connect one patient with many registration . Related registration with officer registration with one to one cardinality , meaning one registration exists one officer registration .

3.3. Develop Prototype and Trial design

The development process is carried out by creating a website-based display. The prototype is intended for patient users and registration officer users. The appearance of the application can adjust the type of device used both with desktop and smartphone devices. This application was developed using the PHP programming language using the My SQL database. Applications are worked on natively in the development process. The trial is carried out during the development process desired by the user. When the application that is presented is not in accordance with what the user wants, there is

a change in the structure and appearance of the application. During the process of making this application, the display was tested three times.

The first trial was carried out by showing the application that had been compiled based on the data collection process through interviews. There are inputs in this first phase of testing. Furthermore, the second trial was carried out by showing the revised results in the second trial. In this second trial, there were inputs related to variable items and features related to the registration process. The medical record number can later be written by the user himself and there is a choice whether the patient goes to what polyclinic. After that, the third trial is related to finalization which has been improved by the user in the data input process. In this trial, the application is considered to be in accordance with what the user wants. So that the application can be said to be the final version in the prototype development process. The final version can be seen in fig. 5. following.
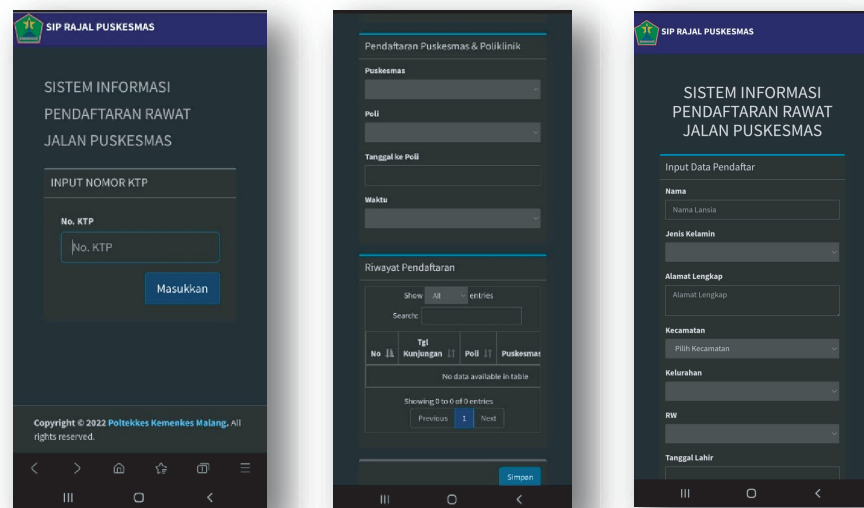

Figure 5: Interface Design Online Registration.

4. DISCUSSION

Service indicators in the registration of outpatients owned by the puskesmas have a time limit. The time indicator for registration services is combined with the time for providing Medical Record Documents (DRM), which is 10 minutes. This means that the time required is less than 10 minutes. The indicator of the time needed is 10 minutes starting from taking medical cards, retrieval to distribution of DRM. This is in

accordance with the Decree of the Minister of Health of the Republic of Indonesia No. 129 of 2008 concerning Minimum Service Standards for Hospitals, it is stated that in the type of medical record service the standard time indicator for providing medical record documents for outpatient services is 10 minutes (9) . So there needs to be an effort in implementing a system that supports the implementation of these service standards. One system that has been widely developed in various sectors is the online system, one of which is online registration.

Online registration is very useful for patients and puskesmas in managing registration data through a website-based application system. The portability of using the system for patients can improve the patient's experience in accessing the application without having to come directly to health care facilities. For puskesmas, patient registration data that has been entered into the system can be used as data to cover visits at the puskesmas. Other studies say that online registration has a lot of impact. Studies in China show that the use of mobile medical apps has an effect on the outpatient experience. Outpatients using mobile medical apps scored the highest experience for convenience of enrollment (10) . The number of visits to a health service in Turkey is quite high. With the existence of a website-based online registration system the time spent in the hospital decreases over time (11) . This shows that adoption related to the use of online application systems can provide opportunities for health care facilities.

The prototype developed in this study has a feature to validate when patients have come to the puskesmas, so they can manage patients who visit the puskesmas. The system will sort the patient queue based on the registration time in the online application. However, when patients who have registered online are not present, this will cause problems related to patient compliance in the systematic use of the application. Prediction models for patient absenteeism are the subject of study for future opportunities. Actually, there have been studies that have discussed the prediction of absenteeism at appointments for health care facilities. This is to assist health services in making relevant decisions, and reduce the possibility of patient absent behavior. All data concerning the patient's history become the benchmark in determining this prediction (12) .

The appearance of this prototype application adheres to a responsive view system, namely the use of the display flexibly on all devices. Interface design designed for heterogeneous devices such as desktop displays and mobile screens must be responsive (13) . This will provide an interaction experience with the application with a level of comfort that is relevant to the user.

This application prototype uses a website-based application. With website media, users don't need to have trouble using this application service. Every device or smartphone already provides a browser application for its use. Users just type in the domain address of this application and can directly use it. The programming language used to develop this application is PHP and My SQL database system. The choice of tools and programming technology for the manufacture of information systems is very relevant to the situation. For each projected system, it is necessary to define a number of criteria for the development environment, the appropriate data dictionary is used with the technology requirements (14) .

Further development of this application is still potential to be done. Testing and testing acceptance of technology will be the key in implementing the application in the next session. Lots of applications were tested using various instruments such as Technology Acceptance Model, PIECES, User Acceptance Testing, Usability Testing, and so on. One of the main things in developing a system is evaluation. The system can be studied how the functions and implementation of the basic things that need to be addressed (15) .

5. CONCLUSION

Step by step has been carried out in the process of developing an online registration application prototype. Needs analysis is the first step in disseminating related to the use of the application later. The use of a structured design can find out the essence of the application and the input items which can later produce an output that can be utilized by the puskesmas. System testing is the most important part in implementing the application into a final product which can later be adopted and can be proposed as a stakeholder policy to implement an integrated information system. The integration of mobile devices into the service system to the puskesmas becomes a data requirement in the future era. Data and information are an important part of the process of providing public health services in the face of integrated technological advances.

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