# Teleassessment System for Geriatric Patient

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Abstract-Medical treatments for elderly patient, known as geriatric, often face problem as the number of old citizens is much larger than the number of geriatric consultants. Furthermore, the geriatric consultants usually reside and provide medical consulting services in big cities. Consequently, geriatric patients from rural areas can not be treated properly. This may in turn cause geriatric patient to suffer from polypharmacy. This kind of problem can be solved by utilizing telemedicine technology. In this paper a teleassessment system for handling geriatric patients is proposed. In this system each geriatric patient is assigned a consultant who is the team leader of a group of persons responsible for caring the geriatric patient, called a geriatric team. The geriatric team normally consists of geriatric consultant, internist, physio, neurolog, dentist, psychic, nutritionist, social worker, and pharmacist. Facilities are provided for each member of the geriatric team. The proposed teleassessment system also has a facility to carry out differential diagnosis analysis, which is based on a case based reasoning technique.

*Index Terms*—case based reasoning, geriatric, teleassesment, telemedicine.

#### I. INTRODUCTION

The Internet has enabled global communication having no distance and time boundaries. One of application that utilizes the Internet is telemedicine. Bellot, d, Cs, have designed a smart agent based telemedicine to handle kidney disease people [3].

Telemedicine is the application of clinical treatment, telephone, internet which utilizes and other communication network for transferring medical information. With this transfer, information can be used for health consultations, and sometimes can also be used for medical procedures in the isolated area (Kusumadewi S, et al, 2009)

Telemedicine technology can be utilized to process the geriatric patient diagnosis that requiring communication among some specialist doctors from different places.

Geriatric is a branch of medicine knowledge discipline that learns old people health problems in connection with promotive, preventive, curative, rehabilitative, and also psycho-social aspects around the old person's livelihood [2].

Some chronic diseases easily become acute and rise clinical symptoms that is not trivial for old person. Investigation results show that 78% of old persons suffer

at least 4 kinds of diseases, 38% suffers more than 6 kinds of diseases and 13% suffers more than 8 kinds of diseases [9]. Chronic diseases will affect the increasing number of drug use and increased treatment costs. Survey at a hospital education, get 30% of geriatric patients get 6 - 10 types of medication, 13% get more than 10 types of drugs each day [10].

Rahmawati, et al (2005), identified Drug Related Problems (DRPs) on 20 geriatric patients that were treated in Bougenville Room at the Sardjito Hospital in Yogyakarta. It showed that the DRPs appear in all sampled cases. The types of DRPs included therapy without indication (75%), inappropriate chosen of drug (45%), the rise of Adverse Drug Reaction (ADR) (30%), patient did not receive drug (15%), overdose (20%), sub therapy dose (10%), indication of having no therapy (15%), and drug interaction that is clinically occured (5%) [12]

Geriatric patient is handled by geriatric assessment that is held by geriatric team. In Dr. Sardjito Public Central Hospital, the geriatric team composed from some elements, such as geriatrics, internist, medical rehabilitator, neurology, dentist, psychic, nutritionist, pharmacist, and social worker.

Geriatric Assessment is lead by a case manager who is usually a geriatric consultant. The purpose of the assessment is to determine the patient's needs. The best management is achieved by setting the priority of the patient's needs. This priority setting is based on:

- 1. Death potential disease.
- 2. Morbidity/disability potential
- 3. Benefit time

The problem of carrying geriatrics assessment is the number of geriatrics consultants that is not comparable to the number of old people. Furthermore, the location of the geriatric consultants, which are mostly in the big city, cause problems in carrying out geriatric assessments. Hence, it needs a media to carry out geriatrics assessment in a long distance by utilizing Internet technology.

In this paper, a design of teleassessment system for geriatric patient is explored. The implementation of this design is expected to increase the number of patient can be served by the geriatric team. It is also expected that the system can minimize the cost of the assessment. The member of assessment team can make assessment from their own places. In other side, the patients do not have to travel to geriatric consultants' location. They can be handled by the local doctor directed by the geriatric consultant.

This teleassessment system will be provided by an analysis of different diagnosis using the case based reasoning method. This facility can be used by the internist, neurology, dentist and psychic. They can select their own variables and cases that may affect different diagnosis. The system then will construct a decision tree based on the variables and cases they selected before. When a new case happens, the system will match the result of different diagnosis by means of traversing the decision tree.

*Case-based reasoning* (CBR) is a problem solving technique based on previous experience knowledge [1].

The problem-solving life cycle in a CBR system consists essentially of the following four parts (see Fig. 1):

- 1. Retrieving similar previously experienced cases (e.g., problem-solution-outcome triples) which problem is judged to be similar
- 2. Reusing the cases by copying or integrating the solutions from the cases retrieved
- 3. Revising or adapting the solution(s) retrieved in an attempt to solve the new problem
- 4. Retaining the new solution once it has been confirmed or validated



Fig. 1. Case Based Reasoning Life Cycle [11]

One of the benefits of developing CBR application is to reduce bottleneck of efforts of knowledge acquisition process. One of the methods for retrieving a case on the case based system is based on the C4.5 algorithm.

The research on building decision tree by using C4.5 algorithm was developed to classify text data for analyzing the probability of new student cancellation from admission process in STMIK AMIKOM Yogyakarta [5][6][7]. The same algorithm is applied for retreiving image, utilizing image fetures[4], and utilizing a combination of text and image features[8].

## II. DESIGN

Geriatric assessment in this teleassessment involves web administrator staff, administration staff, geriatric consultant, internist, physiologist, neurolog, dentist, psychic, nutritionist, social worker, and pharmacist. The web administrator has the privilege to manage other user's access privileges. Administration staff is given the privilege to input patient data and assessment plan. The administrator chooses the geriatric consultant in charge for a geriatric patient when the patient's data is entered.

A geriatric consultant is the leader of the assessment team. He or she will choose the name of other team members. After finishing their assessment based on their respective skills, the geriatric consultant will lead an online discussion. Finally, they reach a final decision of treatment management to the geriatric patient.

The internist has the privilege to assess internist disease of the assigned patient. Internist also has the privilege to manage disease knowledge in conformity with the desired variables. The knowledge built in the case based reasoning system can be used by the internist to analyses the possibility of diagnosis of interna medicine that suffer patient.

A physiologist has the privilege to assess Daily Living Activity (DLA) for the patient under his/her supervision. A neurologist has a privilege to conduct a neurology assessment. Like the internist, a neurologist also has facility to build knowledge and carried out differential analysis diagnosis for neurology disease.

A dentist's privilege is to assess the disease of tooth and mouth. He/she also can build knowledge and carried out differential analysis diagnosis for tooth and mouth disease. A psychologist privilege is to assess psychology disease. He also has the right to build knowledge and performs differential analysis diagnosis for psychological disease.

The nutritionist has the privilege to carry nutritional assessment. A social worker has a right to carry social assessment. And last but not least, the pharmacist's privilege is to carry pharmaceutical assessment to patient.

The schema of the teleassessment system for geriatric patient is shown in Fig.2. Context diagram of this system is shown in Fig.3.

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Fig.2. User interaction in the proposed teleassessment system.



Fig.3. Context Diagram of Teleassesment System

Explanation of Fig.3.:

- 1. user access data
- 2. user list
- 3. assessment team data

4.

- a. assessment team list
- b. patient data
- c. patient identity data
- d. medical history data
- e. physical chek up
- f. supporting data
- g. problem list
- h. FIM assessment
- i. ADL assessment
- j. neurologist assessment
- k. oral assessment
- 1. PMR assessment
- m. Social assessment

5.

6.

- a. patien identity data
- b. medical history data
- c. religion
- d. education
- e. job
- a. Patient list
- b. Patient identity data
- c. Medical history data
- d. physical chek up
- e. supporting data
- f. problem list
- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
- 7.
- a. Medical history data
- b. physical chek up
- c. supporting data
- d. internal medicine diagnosis
- 8.
- a. Patient list
- b. Patient identity data
- c. Medical history data
- d. physical chek up
- e. supporting data
- f. problem list
- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
- 9. Asesmen ADL (FIM)

10.

- a. Patient list
- b. Patient identity data
- c. Medical history data

- d. physical chek up
- e. supporting data
- f. problem list
- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
- 11. Neurolog assessment

12.

- a. Patient list
- b. Patient identity data
- c. Medical history data
- d. physical chek up
- e. supporting data
- f. problem list
- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
- 13. Oral assesment
- 14.
- a. Patient list
- b. Patient identity data
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- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
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17. Nutrision assessment

- 16.
- a. Patient list
- b. Patient identity datac. Medical history data

physical chek up

supporting data

FIM assessment

ADL assessment

oral assessment

PMR assessment

Social assessment

Patient identity data

Medical history data

physical chek up

supporting data

problem list

Patient list

neurologist assessment

problem list

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- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment
- 19. Social assessment

20.

- a. Patient list
- b. Patient identity data
- c. Medical history data
- d. physical chek up
- e. supporting data
- f. problem list
- g. FIM assessment
- h. ADL assessment
- i. neurologist assessment
- j. oral assessment
- k. PMR assessment
- 1. Social assessment

Steps in the health care of geriatric patient:

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- 1. The patient is registered by administration staff.
- 2. The administration staff determines the geriatric consultant as the leader of the assessment team for the patient.

- 3. The geriatric consultant appointed the geriatric assessment team members.
- 4. The patient subsequently assessed by: internist, physiologist, neurologist, dentist, psychologist, nutritionist, social worker and pharmacist.
- 5. The result of assessment in point 4 will be taken to an online conference of the geriatric team.
- 6. The result of the conference is informed to the patient.

Meanwhile, to build the knowledge base, the internist, dentist, neurologist and psychologist have to follow the steps below:

- 1. Select the determining variables that will be used to build the knowledge.
- 2. Select the cases that will be used as the reference cases to build the knowledge
- 3. Execute the training process.

By using C4.5 algorithm, the system builds decision tree based on the cases and variables selected by the user. The decision tree can be used as an analysis tool to determine possible disease that the patient may be suffered from.

Figure 3 shows one of the user interfaces of the proposed teleassessment system design specifically for geriatric patient.

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Fig 3. User interfaces of the proposed teleassessment system

### III. CONCLUSION

Teleassessment system is one solution for problems in handling large number of geriatric patients due to the lack of number of geriatric consultants. By using the teleassessment system, the cost needed to conduct a geriatric assessment can also be minimized since the geriatric team members are not required to be in the same location. The geriatric patients are also helped for they do not need to travel to a hospital in big cities that is far from where the patient live. The patients can be assessed by local doctor that is member of geriatric team.

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