Usability testing of "smart odontogram" application based on user's experience

Arya Brahmanta[1], Aulia Dwi Maharani[2], Bima Sena Bayu Dewantara[3], Sigit R[3], Sritrusta Sukaridhoto[3], Excel Daris Fadhillah[4]

[1]Department of Orthodontics, Faculty of Dentistry Hang Tuah University, Indonesia
[2]Department of Dental Public Health, Faculty of Dentistry Hang Tuah University, Indonesia
[3]Department of Informatics and Computer Engineering, Politeknik Elektronika Negeri Surabaya, Indonesia
[4]Department of Electronic Engineering, Politeknik Elektronika Negeri Surabaya, Indonesia

ABSTRACT

Introduction: Collecting dental data for odontogram in medical records is done chiefly conventionally and causes a lot of human errors. Disadvantages of the conventional method can be overcome by developing a server-based system to store medical information equipped with embedded artificial intelligence (AI), which can identify the patient's dental condition using an intra-oral camera with the help of Deep Learning algorithms. It is essential to evaluate the usability of this application to adapt to user needs. This study aimed to know the user's experience in using this application and also provide information for improvements of the application. **Methods:** This is quantitative descriptive research with 15 users (dentists) as the respondent. The questionnaire was used to measure the user's experience using this application. The user's experiences measured are effectivity, efficiency, and satisfaction. **Results:** The highest scores of respondents on the three variables are extremely efficient, effective, and satisfied (9 people). The lowest score is slightly efficient and neutral on the efficiency and effectiveness variables (0 people). In the satisfaction variable, the lowest score is slightly satisfied (0 people). **Conclusions:** The Usability Testing of the "Smart Odontogram" Application based on User's Experience showed a good result in 3 variables: effectiveness, efficiency, and satisfaction

Keywords: *smart Odontogram; medical record; application; usability testing; user's experience*

INTRODUCTION

Medical records are a must in medical practice. Every dentist who wants to practice in Indonesia must obey Indonesian laws No. 29 year 2004 concerning in Medical Practice. Those law in clause number 46 and 47 regulates about medical records which said that every doctor and dentist

*Corresponding author: Arya Brahmanta, Department of Orthodontics, Faculty of Dentistry Hang Tuah University, Indonesia. Jl. Arif Rahman Hakim - Surabaya, Indonesia Phone: +62 812-3366-0077; e-mail: arya.brahmanta@hangtuah.ac.id

in Indonesia is required to make a medical record for their patient.[1] The regulation of medical records for dentist also found in the regulation of Indonesian Minister of Health (No: 269/MENKES/PER/III/2008).[2] Odontogram is part of dental medical record which contain information by analyzing the overall physical directness of the patient's dental biometrics. The results of manual dentist analysis will be recorded on the odontogram examination form with the assistance of a dental nurse assistant, with the procedure for writing following the National Standards.[3] Dental biometrics for each individual is different, adults have 32 teeth and each tooth has 5 surfaces, then there will be 160 tooth surfaces if the amount is combined with individual dental conditions such as: fillings, cavities, missing teeth and dental prostheses, then two individuals with the same dental biometrics are likely to be 1 to 2 billion more.[4] The Interpol dental charting system employed the World Dental Federation (FDI) tooth numbering system, which divides the dentitions into 4 quadrants, numbered 1 to 4. The upper right quadrant was 1, upper left 2, lower left 3 and lower right 4. Teeth were numbered from the midline to the posterior, e.g., central incisors were #1, canines #3 and third molars #8. Teeth were denoted by a 2-digit code (the quadrant and the tooth).[5]

National Standards for Medical Records of Dentistry regulates the Instructions for filling out the odontogram. Odontogram should consists of a picture with symbol of the treatment or procedure on the patient's teeth that they had been done before and the description of the symbol [6]. Currently, dental examinations are still conventionally carried out by dentists by manually filling out the odontogram by handwritten, that often difficult to read and use abbreviations to be understood. The disadvantage of traditional methods is that the analysis process is quite long, very subjectively depends on the ability of the dentist itself, and if there is an incorrect analysis, the doctor in question does not have comparative data.[7] Technological developments that continue to increase nowadays are very helpful and make it easier for everyone to do anything, one example of those technological development in dentistry is the Smart Odontogram application which is made to make it easier for dentists to fill out the odontogram in dental medical records.[8]

Smart odontogram is an application which developed to assist dentists in filling out odontogram to be more accurate, easier and faster. The way this application works is by inputting the dental image to the system which captured by the intra oral camera and then preprocessed using a median filter, segmentation using watershed, and classification using deep learning machine.[9] The use of deep learning method has implemented by previous to help diagnose patient's tooth. The patient needs to upload their tooth image through an application then the AI would diagnose the patient's tooth condition using MASK R-CNN. The AI could diagnose 7 tooth conditions (dental caries, dental fluorosis, periodontitis, cracked tooth, dental calculus, dental plaque, and tooth loss) with average accuracy above 90% and the recognition rate for dental caries is 90.1%.[10]

The edge computing will use 1-megapixel intraoral camera to acquire tooth image from a patient. The image then will be saved to a personal computer then uploaded to a website and then the disease prediction here will predict the tooth condition using YOLO algorithm. The proposed method for building the edge computing shown on Fig. 1. There are several steps to build the edge computing part, starting from collecting data, annotating, pre-processing, training and finally prediction. Dental images are taken from the intra-oral camera to be used as a training, as well as input to the learning system. This data collection was carried out to collect dental images. In this research, images of healthy teeth and cavities are needed for the needs of making deep learning models.[8] Data Augmentation is performed on the dental image dataset. This process is very useful for helping to vary the images in the dataset so that a sufficient number of images are obtained for model training purposes.[11] In it will be created new images transformed randomly. In this image augmentation stage, several image transformation techniques will be carried out with the help of the "ImageEnhance" library from PIL in the python language.[12] An example of the required data shows on Fig. 2 and 3.

Several studies have performed automatically the assessment of dental condition using image segmentation and classification. Both traditional digital image processing algorithms and deep learning methods are applied in this
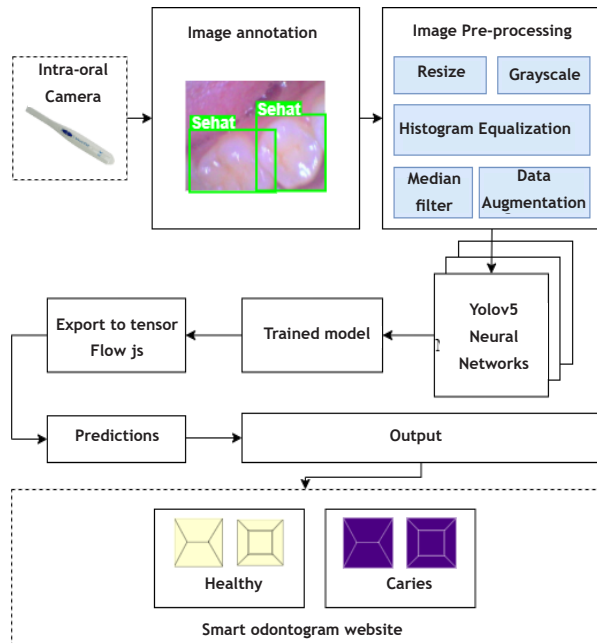
Figure 1. The edge computing process image from intraoral camera

Figure 2. A picture of a tooth captured with intra oral camera

Figure 3. Interpretation of the dental cavity by Smart odontogram application

field. As a new application, an evaluation must be carried out to determine the usefulness of this smart odontogram application for dentists. For that usability testing is used as a method of knowing the ease of users in using this application. This study aimed to evaluate the effectiveness, efficiency and also respondent's satisfaction of using the Smart Odontogram application based on users experience.

METHODS

This is quantitative descriptive research which conducted in July 2021. The population of this study is 15 dentist whom in charge of examining new patients at Nala Husada Dental Hospital. This is a total population research. Questionnaire using Likert scale was performed to measure the user's experience in using this application. The user's experience which measured are effectiveness, efficiency and satisfaction. The division of categories and measurement scores on the Likert scale is presented in Table 1. Each respondent is required to use the application from the beginning to the end by entering one of their patient's data. After finish using the

Table 1. The division of categories and measurement scores

Usability component	Definition	Likert scale
Efficiency	This application can save time	1: Not efficient at all
		2: Slightly efficient
		3: Neutral
		4: Very efficient
		5: Extremely efficient
Effectiveness	This application allows to accomplish task	1: Not effective at all
		2: Slightly effective
		3: Neutral
		4: Very efficient
		5: Extremely efficient
Satisfaction	Prefer to use this application than other / Satisfied with this application	1: Not satisfied at all
		2: Slightly satisfied
		3: Neutral
		4: Very satisfied
		5: Extremely satisfied

application, respondents were asked to fill out an online questionnaire directly on the application. All data were collected, analysed and presented in diagram.Ethical permission was obtained from ethics and scientific research committee of Nala Husada Dental Hospital (KEPK/EC/006/NALA. RSGM/XI/2021).
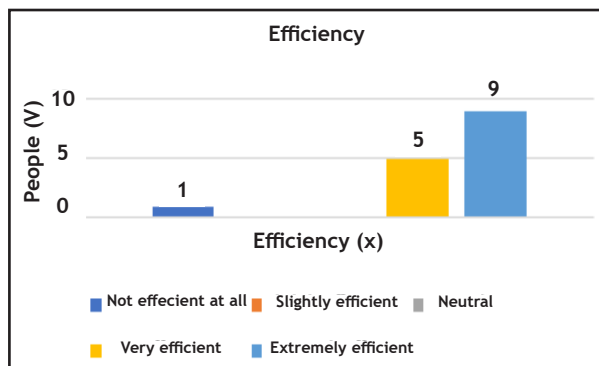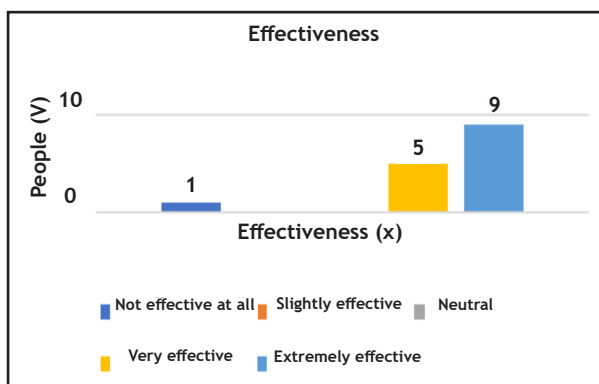
Figure 4. Diagram of Efficiency Variable

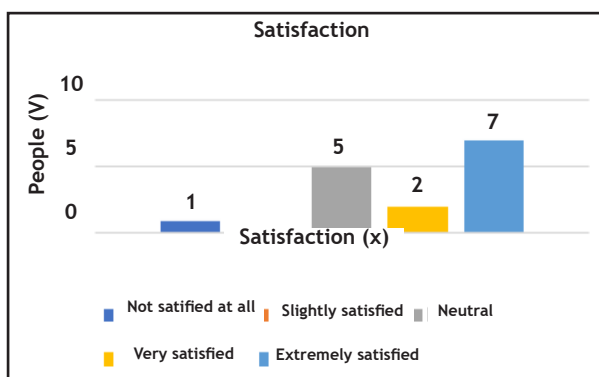**Figure 5. Diagram of Effectiveness Variable**

Figure 6. Diagram of Satisfaction Variable

RESULTS

The efficiency diagram (figure 4) showed the efficiency level remains around 60% extremely efficient, 33.4 % very efficient and only 6.7 % respondent level is not efficient at all. The effectiveness diagram (figure 5) showed the software application obtained effectiveness level remains around 60% extremely effective, 33,4 % very effective and only 6,7 % said no effective at all. The satisfaction diagram (figure 6) showed the software application obtained effectiveness level remains around 46,7% extremely satisfied, 13,4 % very satisfied and only 6,7 % said not satisfied at all.

The highest scores of respondents on the three variables are extremely efficient, effective and satisfied. While the lowest score is slightly efficient and neutral on the efficiency and effectiveness variables. In the satisfaction variable the lowest score is slightly satisfied. It should be noted that there is 1 respondent who answered not at all on the three variables who needs to be considered.

DISCUSSION

In Dentistry, the increasing demand in the use of these technologies aims to facilitate the daily practice of the dental professional, be it as manager, clinician, researcher or lecturer. A large part of health professionals' tasks consists of processing information: obtaining and recording patient's data, consulting their colleagues in the profession, researching specific scientific literature, diagnostic procedures, treatment planning and strategies, interpretation of examinations or guiding epidemiological studies.[13]

The following stage of the study consisted in determining the users experience for the usability test. Usability testing was performed to understand all functions that can work within an interface of a system, that focus on user that will be using the system. During application development, it is recommended to perform usability tests to identify possible problems in the interaction between the user and the interface, before commercialization. An application's usability can be assessed by harmonizing its primary attributes: the potential of the interface to be understood by the user ("effectiveness"), by way of easy navigation ("efficiency"), that is user friendly ("satisfaction").[14]

The efficiency and effectiveness testing showed the same result. Most of respondents felt this application was extremely efficient. Since filings odontogram data takes a quite long time, they thought this application would saves their time in the future. The rest of the respondents felt this application very efficient. Respondents felt that this application would help to ease their work even though at this time they could not give a perfect score because the application was still under development. Even though most of respondent felt this application was extremely and very afficient there is 1 people felt this application

is not efficient at all. Based on interview, dentists as the user felt it was easy to use this application meanwhile some people said it was not. This difficulty can arise because the smart odontogram is the first application that has been developed means there has been no previous application like this.

For the first time use for some it will feel difficult. Probably compare to the previous study by Nugraheni, it obtained an efficiency value of 87.4%, the respondents felt they could use the system properly without needing help and the rest still need help. User often makes mistakes the first time he/she uses this application. The lowest value for the aspect of efficiency is because respondents are note accustomed to using computers or high technology programme and prefer conventional system.[15]

Nowdays, application users have more complex needs/demands on the providers. One of the aspects that must be fulfilled is the connection speed in the system. The result of Smart odontogram's respondents showed more dentist satisfied with the speed although some people feel plenty satisfied with speed. The speed of this application is still being improved because this application is still under development. User evaluations will become next input for developers.

Based on interviews with respondents, it is known that the majority of respondents feel that this application is very useful because it can save their time in filling out the odontogram where sometimes this activity is often missed for fear of taking a long time even though they already know that filling out the odontogram completely is mandatory and important. Related to the previous study by Walji Quantitative results from user testing provided an assessment of effectiveness (task success) users struggled to successfully complete the tasks. Task 1 had a higher success rate (22–41%). Several user interface related challenges were discovered that were preventing users from successfully finding and selecting a diagnosis and as a result, degrading efficiency and causing errors. One of the most common problems experi- enced by users was finding an appropriate concept from a long list of items due to the illogical ordering of the terms in the display screen.[16]

Most of respondents for Smart Odontogram application felt extremely and very satisfied about this application. They said that this application is very useful for their activities as a dentist, however fewer respondent disagrees. Based on interviews with respondents, they disagree due to 3 things: still able to do it manually so they don't need help from the application, they don't really understand its use so they don't feel the benefits and not familiar with things related to the latest technology. The provision of manual books and introduction of this application will be carried out in the future so that it is easier for users to use this application. Perception of the ease of use or convenience of a technology is defined as a measure by which a person believes that a technology can be easily understood and used.[17]

Based on the three variables studied to show users experience with the smart odontogram application, all variables showed the majority good results. Although there are still some respondents who are not satisfied, their dissatisfaction will become input for the development of this application in the future.

CONCLUSIONS

The Usability Testing of "Smart Odontogram" Application based on User's Experience showed this application can save most of respondent's time (efficiency variable) and allows to accomplish most of respondent's task (effectiveness variable). Most of respondent satisfied with this application.

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