Keystroke-Level Model to Evaluate Chatbot Interface for Reservation System

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***Abstract*—The tour package reservation system is an important part of improving tourism services. Reservations must be able to meet the information needs of prospective customers and can serve the desired tour package bookings. A reservation system is usually a form that must be filled in sequence by prospective visitors. This paper discusses the evaluation of the application of the chatbot interface on the reservation system with the keystroke-level model. Changing the interaction design that previously did the task fills out the form into a conversation interaction. The aim is to increase the speed of the ordering process through the system. Prospective visitors do not need to fill in the form, they only need to have a conversation with the system while entering the order data. The evaluation results using the keystroke-level model show that the chatbot interface can increase the speed of the process by shortening steps.**

Keywords—chatbot interface, interaction design, keystroke-level model, reservation system

I. INTRODUCTION

Ecotourism in Indonesia is increasing rapidly both in terms of quantity and quality. Ecotourism that is not managed properly will not last long. Although many have used information technology. One factor in the lack of management is that there is no data available.

Information technology has been widely used in management and service. Examples of web applications that contain news, galleries, testimonials, and guest books. One of the goals is to obtain and store data properly. The reservation system for booking tour packages plays an important role to improve tourism services. This system must be able to meet the information needs of prospective customers and can serve the desired tour package bookings.

The reservation system is usually in the form that must be filled one by one sequentially by prospective visitors. Based on the results of observations this causes potential visitors difficulties when making the order process. This indication can be seen from the number of visitors who order through the system an average of 100 visitors per year. This number is very small compared to the total number of visitors per year that can reach 2000 visitors per year.

The challenge faced is how to improve reservation system services by implementing a new interface approach. Change the design of the interaction that previously made the task into a conversation interaction. The conversation interaction used is the chatbot interface [1]. The system will automatically respond according to the answer entered by the user. The aim is to increase the speed of the ordering process through the system. Prospective visitors do not need to fill in the form, they only need to have a conversation with the system while entering the order data.

This paper evaluates how the interface chatbot is implemented for a reservation system using the keystroke-level model (KLM) [2]. The system is evaluated based on the speed of the user completing a task. The task to be measured in the process of ordering tour packages with certain scenarios. The results of this evaluation can be used as evidence that the chatbot display can provide time efficiency on the system. Long-form displays and the amount of activity can also be reduced by applying this chatbot interface.

II. RELATED WORK

After applying gamification to information systems to increase user involvement [3]. These research results need to be considered to improve the quality of interactions and interfaces in the ordering system. The purpose of implementing chatbots is to increase user involvement. What makes chatbot do that.

Basically, chatbot is a system with conversation interaction. When users operate the application, they do not need to understand what sequence of tasks must be completed. The chatbot system will always respond to what users do. Furthermore, lead users to continue to complete the task.

Chatbots have been widely used in various applications such as health [4], education [5] and customer service [6]. The research that developed the chatbot application for city citizen interaction media [7], stated that chatbots provide convenience to users because users do not have to do a long order of commands. Chatbot can also improve user experience because it provides stable activity [8].

Even chatbot has been used in university resource booking application [9]. This research shows that chatbot provides efficiency and saves processing time in the resource booking system.

Chatbot makes users do existing tasks in a flowing system such as talking to the system. This is in line with other studies evaluating chatbot-based system designs [10]. This study

concludes that chatbot-based systems must pay attention to error-tolerant and how to end conversations properly.

III. METHODOLOGY

This paper uses the KLM method to evaluate the chatbot design made to build a reservation system. GOMS model consists of four elements, namely Goals, Operators, Methods and Selection Rules. KLM focuses on the use of physical activity (keystroke level) but still refers to the methods that are in GOMS [11][12].

KLM calculates the time needed to add the preparation time and execution time. This paper discusses KLM for the mobile display. Some modifications to the keystroke level in PCs that have a mouse and keyboard [13]. There needs to be an H code (hand) that is used to transfer hands from mouse to keyboard. This paper uses five types of keystroke operator just as shown in Table I.

TABLE I. KEYSTROKE OPERATORS

Operators	***Descriptions***
M	Mental Preparation
P	Pointing to a target
B	Button press or release
K	Keystroke or Button Press (Keyboard)
H	Moving hand to keyboard

The keystroke measured in this paper includes:

1. Tap interactions in the reservation application in the mobile analog display are the same as code B (Button). Code B is to click and release the button, it is assumed that each object is the same as a button. It's just different in the pressing process.
2. Keypress and typing to evaluate how quickly the user presses a button on the virtual keyboard.
3. Pointing to evaluate how long it takes the user to move his finger from the position of the initial object to the position of the object of his destination.
4. Scrolling and Swiping to measure how long the process to find information on the screen.

IV. IMPLEMENTATION

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

A. System Architecture

The system asks questions to the user then the user gives an answer that will be captured by the system as the contents of the reservation form, after that the system will respond to the answer from the user by giving more questions until the last stage of the reservation process is completed. The architecture of this chatbot system is solid seen in Fig 1.

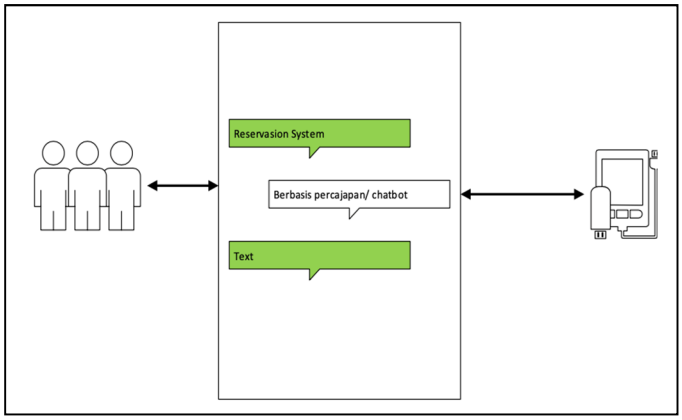

Fig. 1. Chatbot Erchitecture

B. Develop Prototype

This chatbot system was built using framework Codeigniter with PHP language and Javascript. The system uses a session to capture conversations sent by the user and determine which questions will be returned to the user. Data flow between proses handled by Javascript function. Javascript also handle interface flow.

Chatbot interfaces are built using native CSS and Javascript. Conversation interactions are handled with a Javascript methods: add, append, and remove HTML elements. Javascript code snippet to bring up message bubbles is shown in Fig 2.

Chatbot interface is made without applying Natural Language Processing and other libraries. Chatbot system response is made by making a Javascript function that is invoked on the previous Javascript function following the sequence of tasks that must be done by the user.

```
211  function msg(id, step){
212    $.ajax({
213      url : "form/set_step/" + id + "/" + step,
214      type: "POST",
215      dataType: "JSON",
216      success: function(data) {
217        $('#textmsg').on('keypress', function (evt) {
218          var charCode = (evt.which) ? evt.which : event.
               keyCode
219          if (charCode > 31 && (charCode < 48 || charCode >
               57)) {
220            $('#textmsg').parent().parent().addClass('
                 has-error');
221          } else {
222            $('#textmsg').parent().parent().removeClass('
                 has-error');
223          }
224        });
225        $('.message-input').focus();
226        $('<div class="message loading new"><span></span></
             div>').appendTo($('.mCSB_container'));
227        updateScrollbar();
228        setTimeout(function() {
229          $('.message.loading').remove();
230          $('<div class="message new">Berapa hari anda akan
               berwisata? <br>ketikkan angka jumlah harinya
               saja</div>').appendTo($('.mCSB_container')).
               addClass('new');
231          // setDate();
232          updateScrollbar();
233        }, 2000);
234      }
235    });
236  }
```

Fig. 2. Javascript Snippet Code.

The design of the prototype system is based on the task-centered design. There are several tasks that users must do on the reservation system:

- Open the reservation page
- Users learn the tour packages offered
- Fill in the Check-In Date
- Fill in the Check-Out Date.
- Fill in the number of groups
- Fill in the number of adults
- Fill in the number of children
- Fill in the name of the buyer
- Fill in the telephone number
- Fill in the Email
- Fill in the full address
- Submit reservation data and Done

In the initial layout, the system asks questions while offering available tour packages. Users are asked to choose which package to order. The initial appearance of the chatbot system can be seen in Fig 3

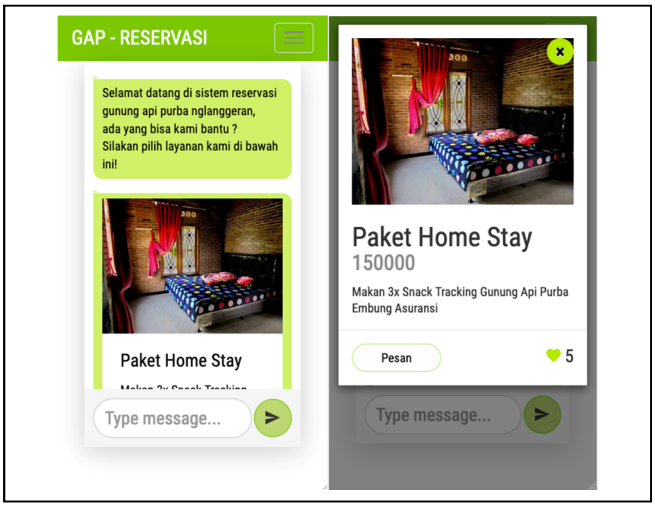

Fig. 3. The initial and second layout

The next display the user is asked to fill in the number of days by just entering the number, then the user is asked to fill in the check date by pressing the calendar icon and selecting the date as desired. Then the system will provide questions regarding booking tours made. The date input process can be seen in Fig 4.

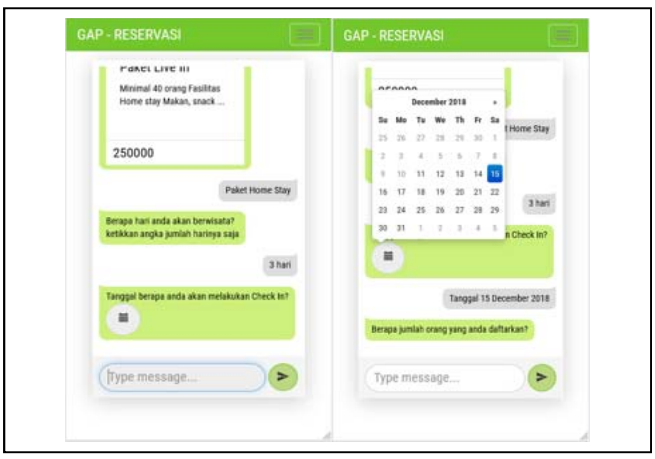

Fig. 4. Third until sixth layout

After all the reservation process is complete the system will return the answers that have been inputted by the previous user in the form that users can easily see. After finding the data entered is correct, the user is asked to choose the "Yes" button to submit the order. After that, the system will display an invoice card that contains all the ordering details according to what has been entered along with the total price and booking price. This invoice card is equipped with a QR-code that makes it easy for users to register at tourist locations. The invoice card can be seen in Fig 5.

Fig. 5. Finishing and Invoice Layout

C. KLM Evaluation

KLM evaluates the old form system shown in Fig 6 and the chatbot interface. The scenario evaluated is a tour package booking scenario assuming the user does not know the packages offered. The sequence of tasks for the scenario starts from the user selecting the package until the order has finished. Evaluation was conducted by using a mobile device. So it does not require a physical keyboard and mouse.

Testing and comparison follow the scenario:

- User is already on the reservation page. (Users no longer need to enter the URL address of the application)
- Users don't know the kinds of tour packages offered. Users need to find information about the packages offered in the application.
- Fill in the Check-In Date December 25, 2018.
- Fill in the Check-Out Date December 27, 2018.
- Fill in Total ordering of 4 people.
- Fill in Number of adults 2 people.
- Fill in Number of children under 5 years old 2 people.
- Fill in name with Adi.
- Fill in Phone Number with 087830598187.
- Fill in Email adi@gmail.com.
- Fill in Complete address with Jogjakarta.
- Doing the booking confirmation (only available in the new system)
- Print e-tickets (only available in the new system)

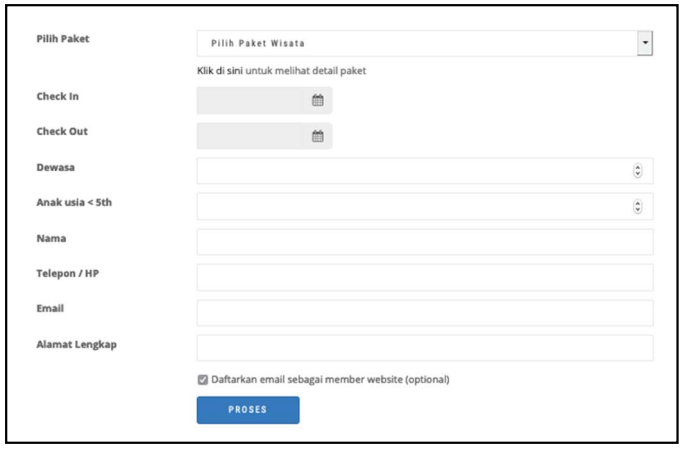

Fig. 6. The system with an old form interface

1) The system with Regular Form

On the old system that uses regular forms, the user can complete the tour package reservation task by completing two subtasks. The first subtask is the task of selecting a tour package, and the second subtask fills in detailed customer information. The package selection subtask is shown in Table II. The activity of selecting a package consists of eleven steps.

TABLE II. PACKAGE SELECTION ACTIVITIES

No.	*Steps*	*Codes*
1.	Mental preparation	M
2.	Hover over the input select tour package	P
3.	Click form select tour package	BB
4.	Hover over to any place	P
5.	Click anywhere to remove dropdown select tour package	BB
6.	Hover over the “klik disini” link to view packages	P
7.	Click the link “klik disini” To see the tour package	BB
8.	Pointing in the form or scroll down to see package details	P
9.	Mental preparation/thinking of choosing a tour package	M
10.	Hover over the package to be selected	P
11.	Click the “RESERVASI” button to choose a tour package	BB

Subtask complete the reservation data shown in Table III contains eight steps. Each stage consists of several detailed tasks, so this subtask has a total of thirty activities.

TABLE III. COMPLETE RESERVATION DATA ACTIVITIES

No.	*Steps*	*Codes*
1.	Hover over the "Check In" form - Click the "Check In" form - Hover over to December 25, 2018 - Click on that date - Hover on December 27 - Click on that date	P-BB-P-BB-P-BB
2.	Hover over the "adult" form - Move hands to keyboard - Type number 2	P-H-K
3.	Move the cursor to the form "children aged <5 years" - Click on the form - Move hands to the keyboard - Type number 2	P-BB-H-K
4.	Hover over the "name" form - Click the form - Move hand to keyboard - Type "adi"	P-BB-H-KKK
5.	Move the cursor to the form "children aged <5 years" - Click the form - Move hands to the keyboard - Type "087830598182"	P-BB-H-KKKKKKKKKKKK
6.	Hover over the "Email" form - Click on the form - Move hand to keyboard - Type adi@gmail.com	P-BB-H-KKKKKKKKKKKK
7.	Hover over the "Full Address" form - Click on the form - Type "Jogjakarta"	P-BB-KKKKKKKKKK
8.	Hover over the process button - Click the button	P-BB

2) The system with Chatbot Interface Evaluation

Evaluation of new systems implementing chatbot displays is not divided into subtasks. Following the natural activity of the conversation, users will follow the flow of the conversation by typing responses or requests through one form. Additional activities besides typing responses or commands are scrolling and pressing buttons. The steps for completing the reservation task shown in Table IV have ten steps consisting of a total of thirty-one activities.

TABLE IV. RESERVATION ACTIVITIES WITH NEW SYSTEM

No.	*Steps*	*Codes*
1.	Mental preparation - Hover over the desired package title (e.g. Outbound Package) - Click on the package	M-P-BB
2.	Scroll down to see package details - Click the message button - Switch hands to the keyboard - Type the number of days you travel, type number 2 - Press enter on the keyboard	P-K-H-K-K
3.	hover over the calendar icon in bubble chat - click the calendar icon - hover over the date December 25 2018-then click the date - press enter on the keyboard	P-BB-P-BB-K
4.	type in the number of people registered, type 4 - Press enter on the keyboard	K-K
5.	Type the number of adults registered, type the number 2 - Press enter on the keyboard - Type the number of children aged under 5 years, type number 2 - Press enter on the keyboard	K-K-K-K
6.	Type the name of the user, type "adi" - Press enter on the keyboard	KKK-K
7.	Type the telephone number, type "087830598187" - Press enter on the keyboard	KKKKKKKKKKK-K
8.	Type the e-mail address of the buyer, type adi@gmail.com - Press enter on the keyboard	KKKKKKKKKKK-K
9	Type the full address, "Jogjakarta" - Press enter on the keyboard	KKKKKKKKKK-K
10	Mental preparation/thinking "matching resume data" - Hover over the "Yes" button - Click the button - Hover over the "print" button - Click the "PRINT" button	M-H-BB-H-BB

V. Discussion

When analyzing the ratio of the number of keystroke activities between the old system and the new system, it is clear that the new system only requires 31 activities while the old system requires 41 activities. This means that the new system was superior in the number of activities to complete the task reservation.

But the comparison of the number of activities is not enough to prove the superiority of the new system. Then what about the time it takes the user to complete his task on each system. Calculation of the estimated time adjusted by the code/operator generated in each activity [14].

The chatbot interface needs to be evaluated with various types of users because the reservation system can be used by anyone who will travel. Scenarios involve several types of users based on the speed of typing on the virtual keyboard. The type of user who is accustomed to using mobile devices for typing is called **good typists**, users who rarely use mobile devices for typing are called **average typists**, and users who very rarely use mobile devices for typing are called **worst typists**.

Calculation of the estimated time for a good typist is 0.12 seconds. This means users can type 90 words per minute. This condition allows users to enter reservation data faster. The estimation results shown in Fig 7 on the old system are 30.8 seconds. While the estimation of the new system is 16.42 seconds. The new system is 14.38 seconds faster than the old system for good typist users.

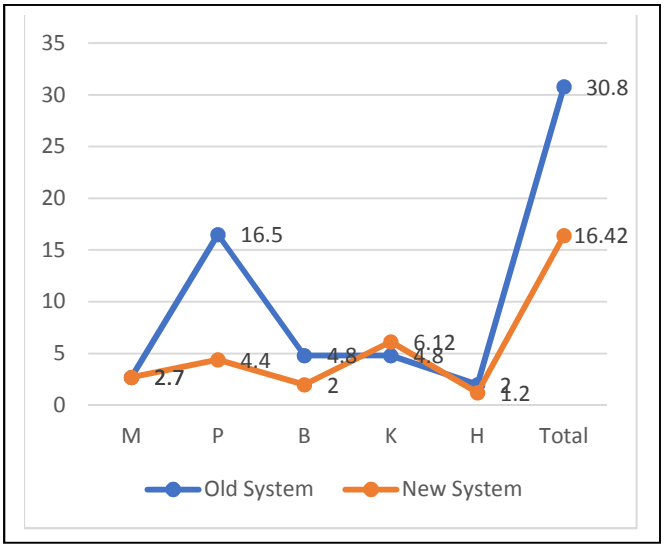

Fig. 7. Good Typist Time Estimation Result

Calculation of estimated time for average typist is 0.2 seconds. This condition is the speed of the average user typing in words or sentences using the keyboard. The average user can type 55 words per minute. The estimation results shown in Fig 8 on the old system are 34. While the estimation of the new system is 20.5 seconds. The new system is 13.5 seconds faster than the old system for average typist users.

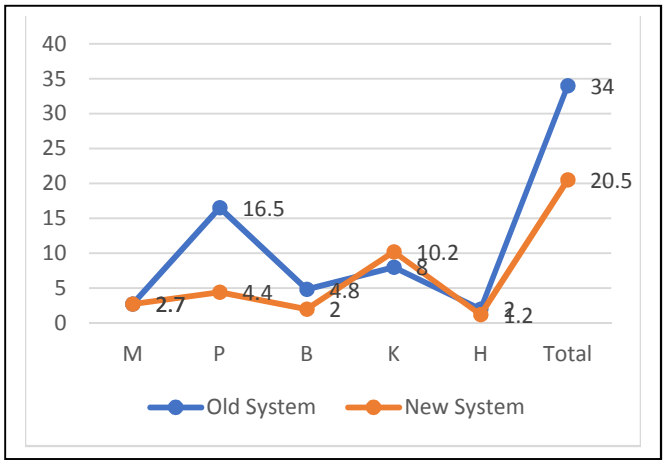

Fig. 8. Average Typist Time Estimation Result

Calculation of the estimated time for the worst typist is 1.2 seconds. The estimation results shown in Fig 9 on the old system are 74 seconds. While the estimation of the new system is 71.5 seconds. The new system is 2.5 seconds faster than the old system for the worst typist users.

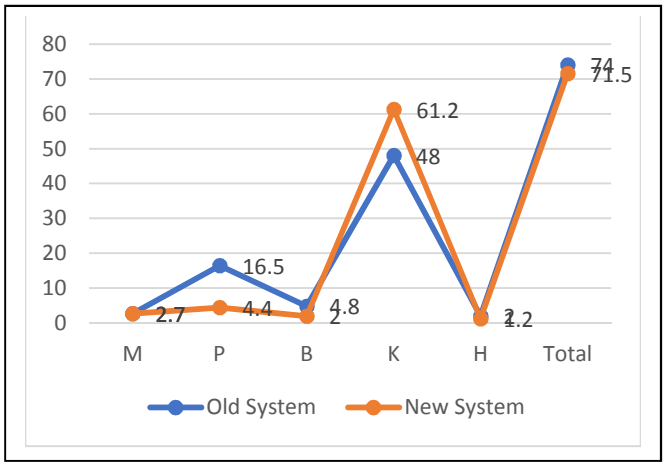

Fig. 9. Worst Typist Time Estimation Result

Significant results were obtained from the best typist and average typist users. The time difference is 13 to 16 seconds. But at the worst typist, the time difference is only 2.5 seconds.

VI. Conclusion

Based on the Keystroke-level Model evaluation, the chatbot interface completes reservation tasks faster than the old system that uses regular forms. The speed is 13 to 16 seconds faster than conventional forms.

But there are still shortcomings in the chatbot interfaces are offered, namely the user with the worst kind of typist. Chatbot interfaces need to be improved by implementing intelligent systems. Several mechanisms can be applied such as a retrieval system, natural language processing and the application of deep learning to improve system responsiveness.

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